



**ATMOSPHERIC PROFILES STATISTICAL ANALYSIS  
PART 1: HIGH-ALTITUDE PROFILES**

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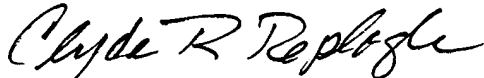
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FOR THE DIRECTOR



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# **ATMOSPHERIC PROFILES STATISTICAL ANALYSIS**

## **PART 1: HIGH-ALTITUDE PROFILES**

### **1.0 INTRODUCTION**

The objective of this analysis is to provide statistical descriptions of vertical (height-variable) wind profiles. Order statistics (e.g., minimum, median, maximum, and intermediate percentiles) are used to describe the profiles.

### **2.0 APPROACH**

The basic approach to accomplish this objective is as follows:

1. Process the raw wind profiles into a form suitable for input to simulation programs (Section 3);
2. Simulate transport and diffusion of agent after being intercepted at high altitude (Section 4); and
3. Compile sets of wind profiles based on order statistics of droplet downwind travel distances and spread distances (Section 5).

### **3.0 DATA**

Wind profile data have been obtained from the Air Force Air Weather Service for ten locations: Fritzlar, Germany; Trapani, Sicily; Ankara, Turkey; Dhahran, Saudi Arabia; Riyadh, Saudi Arabia; Pokang, South Korea; Cheju, South Korea; Kwanju, South Korea; Osan, South Korea; and Bet Dagan, Israel.

Wind profile data are derived from weather balloon ascents and consist of wind speed, wind direction, and pressure data usually reported twice a day. Since many data points are either

invalid or missing, pre-processing of wind profile data involves determination of the valid height for each profile. If a profile's valid height is above 5, 10, 20, or 30 km, then the profile can be used to simulate an intercepted munition at an altitude of 5, 10, 20, or 30 km, respectively.

Wind profile data are used as input to simulate transport and diffusion of agent after intercept at high altitude.

#### **4.0 SIMULATIONS**

Wind profile data are used as input to the High Altitude Version of NUSSE4 (HAVN4). NUSSE4 is the Non-Uniform Simple Surface Evaporation model, version 4, which simulates transport and diffusion of agent disseminated from a single munition. Unlike NUSSE4, HAVN4 permits the use of vertical wind profiles as input.

For this analysis, HAVN4 is used to simulate the trajectory of a "small" drop (0.5 mm) and a "large" drop (6 mm) subject to each wind profile. The distance between the impact points of these two drops is termed "spread distance", a measure of dispersion resulting as liquid agent droplets fall through each wind profile. Spread distance provides a relative measure of potential dispersion for each wind profile so that order statistics can be obtained.

The spread distance measure was originally used to determine which atmospheric profiles had the greatest dispersing power for clouds of liquid chemical agent resulting from the intercept of a bulk chemical filled tactical ballistic missile. Although the spread distance measures are determined by tracing the paths of falling 0.5 and 6 mm drops, the ranking of the atmospheric profiles applies to any ballistic body. That is, the atmospheric profile that produces the greatest spread between impact points of 0.5 and 6mm drops will also produce the greatest spread between 1 and 3 mm drops, or for that matter two different types of ballistic (non-flying) submunitions. These rankings apply to any pair of objects whose only ballistic difference is their fall speed.

Another measure of dispersion is the "travel distance", which is the distance between the large drop (6 mm) impact point and the point of interception. Spread distance estimates the size of

the ground contamination pattern; travel distance estimates the distance traveled from the point of interception.

Atmospheric profiles ranked by travel distance can be used to determine circular error probable (CEP) effects caused by uncertainty with respect to the wind profile. An analyst could determine the "nominal" impact point by using the median profile as input to the object's flight path determination program. The distance between this impact point and the object's release point (actually the point on the ground directly under the release point) represents the CEP component due to the atmospheric wind profile. Since the nominal impact point is determined using the median profile, on any random day an object released at the same altitude has a 50% chance of being blown further than the nominal distance and a 50% chance of being blown less than the nominal distance and thus the CEP designation. The above statements hold if the objects released have no horizontal momentum. If momentum is involved as in the case of a submunition release from a slanted trajectory, then a slight modification must be made to this technique. In this case the (0,0) point is determined by using the flight path program with no wind profile. The impact point is representative of the object's trajectory (arced in this case due to momentum) through calm air. The same release is repeated using the median travel distance wind profile to compute the "nominal" impact point. The distance between these two impact points represents the CEP component from the wind profile.

## 5.0 ORDER STATISTICS

For each of the ten locations considered in this effort, spread distances and travel distances have been estimated for each wind profile at each intercept altitude (5, 10, 20, and 30 km) for which the wind profile is valid. For each station and intercept altitude, the resulting distances are sorted to obtain the following order statistics: minimum, 5th percentile, 10th percentile, 25th percentile, 50th percentile (median), 75th percentile, 90th percentile, 95th percentile, and maximum.

These order statistics describe the set of wind profiles at each station by identifying the cases which produce spread distances and travel distances at the indicated levels. The wind profile corresponding to either the minimum or the 5th percentile spread distance may be considered a "worst-case" wind profile, since a smaller spread distance (i.e., the contamination pattern on the

ground is less disperse) corresponds to areas of higher contamination levels. Similarly, the wind profile corresponding to either the maximum or the 95th percentile spread distance may be considered a "best-case".

In general, larger distances result in wind profile cases having both higher wind speeds and lesser directional fluctuations.

## **6.0 RESULTS**

Results are shown by location. The first table under each location heading is a table of order statistics for spread distance at each intercept altitude. The second table is a table of order statistics for travel distance at each intercept altitude. Figures illustrating selected wind profiles correspond to the tabulated distances and the profiles follow the tables. Figures illustrating cumulative frequency distributions for travel distance and spread distance are presented in Appendix A.



## 6.1 Fritzlar, Germany

**Table 1. Table of Spread Distances (m), Fritzlar, Germany**

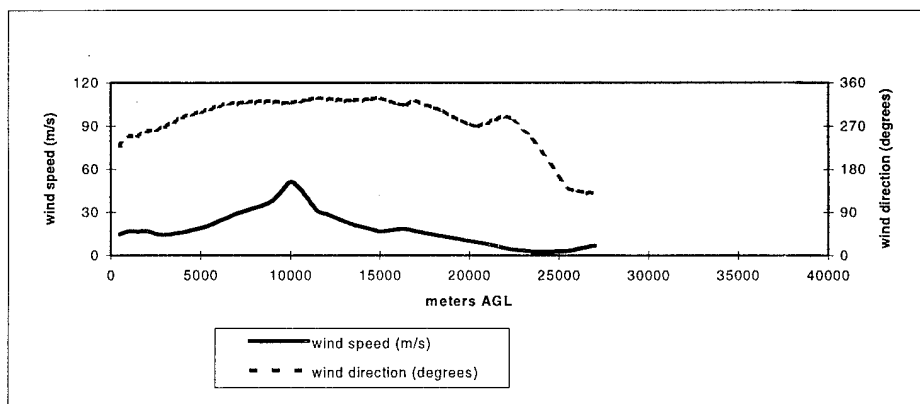
Order Statistic	Intercept Altitude					
	5 km			10 km		
	Spread Distance	Date/Time	Figure No.	Spread Distance	Date/Time	Figure No.
Minimum	310.	910506-1000	11	217.	910802-0400	15
5th percentile	4000.	910913-1000	21	9759.	910314-0200	6
10th percentile	5644.	920710-0100	44	13775.	921013-1100	49
25th percentile	9762.	920630-1600	43	23249.	911016-0200	25
Median	16012.	910705-0700	14	38841.	920323-1100	34
75th percentile	24549.	920301-2300	31	61195.	910812-2200	17
90th percentile	32658.	921015-1500	52	82196.	920214-1400	30
95th percentile	37307.	921015-0500	51	93698.	910102-0800	2
Maximum	65960.	921125-1400	56	204516.	921125-1400	56
Number of Valid Profiles	2339			2107		

Order Statistic	Intercept Altitude					
	20 km			30 km		
	Spread Distance	Date/Time	Figure No.	Spread Distance	Date/Time	Figure No.
Minimum	4266.	920625-0400	42	7673.	921223-1100	57
5th percentile	12498.	911011-0800	24	13790.	921006-1100	48
10th percentile	18571.	911009-0800	23	20919.	910822-0400	19
25th percentile	32898.	920526-0400	37	33739.	920609-1000	40
Median	64728.	910826-1000	20	53491.	920602-1000	39
75th percentile	111299.	910101-2300	1	94442.	910624-1000	12
90th percentile	140873.	910320-1100	7	135454.	921103-1100	54
95th percentile	155987.	911206-1700	26	181213.	910930-0500	22
Maximum	217107.	921014-2300	50	204804.	921104-1100	55
Number of Valid Profiles	279			41		

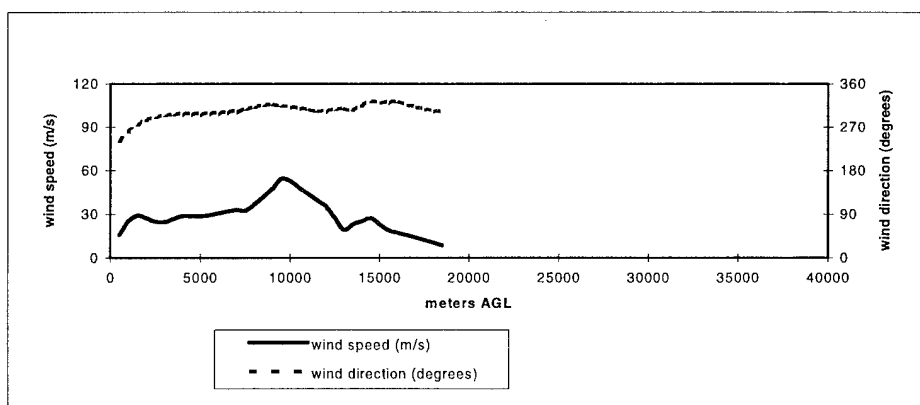
**Table 2. Table of Travel Distances (m), Fritzlar, Germany**

Order Statistic	Intercept Altitude					
	5 km			10 km		
	Travel Distance	Date/Time	Figure No.	Travel Distance	Date/Time	Figure No.
Minimum	91.	910506-1000	11	277.	910419-1000	9
5th percentile	1386.	920309-0800	32	3170.	910212-0500	4
10th percentile	1939.	921001-2300	47	4444.	910822-0400	19
25th percentile	3342.	910430-1300	10	7449.	910805-1900	16
Median	5490.	910220-0200	5	12425.	920317-1100	33
75th percentile	8393.	910624-2200	13	19591.	920106-1100	28
90th percentile	11147.	920102-1700	27	26147.	920427-1600	36
95th percentile	12735.	910106-2000	3	29919.	920205-1100	29
Maximum	22484.	921125-1400	56	64594.	921125-1400	56
Number of Valid Profiles	2339			2107		

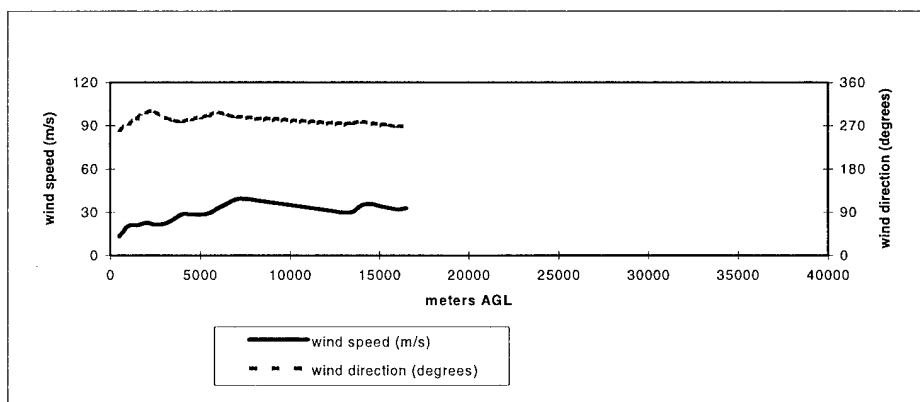
Order Statistic	Intercept Altitude					
	20 km			30 km		
	Travel Distance	Date/Time	Figure No.	Travel Distance	Date/Time	Figure No.
Minimum	626.	920625-0400	42	1474.	920625-0400	42
5th percentile	3963.	921223-1100	57	5019.	920624-0400	41
10th percentile	5084.	920324-1100	35	6212.	910822-0400	19
25th percentile	9365.	920602-0100	38	9656.	920928-1100	46
Median	18353.	910409-2200	8	15325.	920602-1000	39
75th percentile	31898.	910101-2300	1	27158.	910819-0400	18
90th percentile	40878.	921027-1100	53	34784.	920812-2200	45
95th percentile	44945.	911206-1700	26	50806.	910930-0500	22
Maximum	62975.	921014-2300	50	55003.	921104-1100	55
Number of Valid Profiles	279			41		



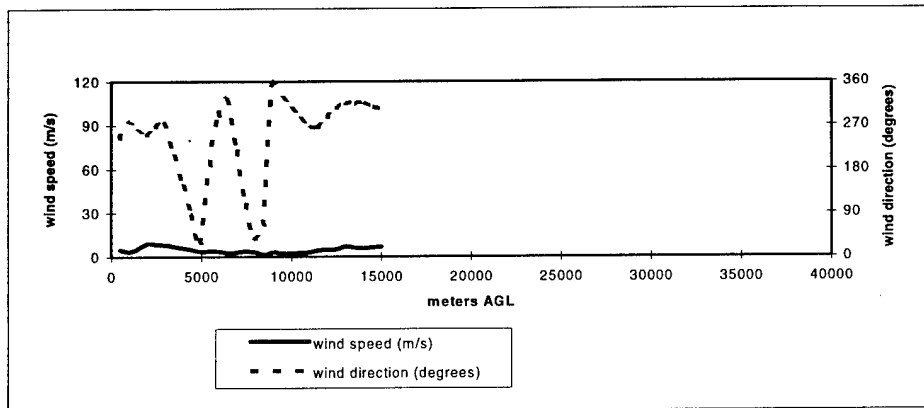
**Figure 1. Fritzlar 910101-2300**



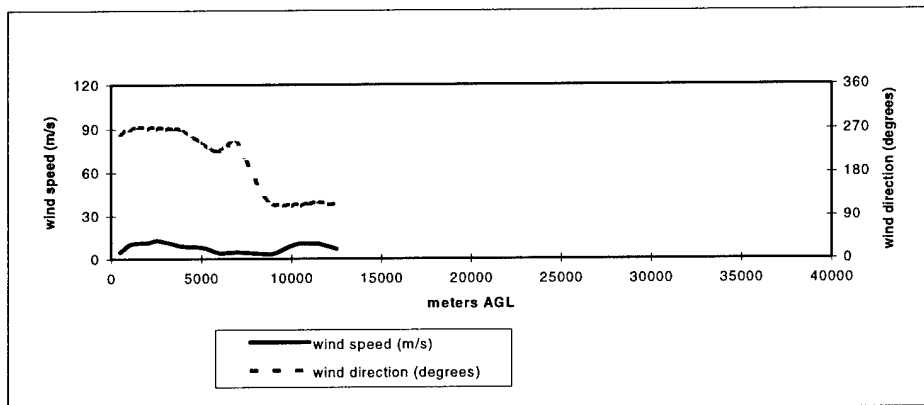
**Figure 2. Fritzlar 910102-0800**



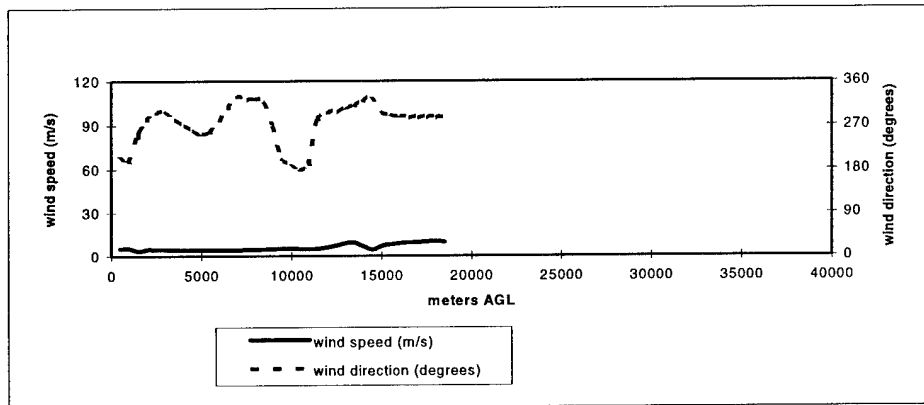
**Figure 3. Fritzlar 910106-2000**



**Figure 4. Fritzlar 910212-0500**



**Figure 5. Fritzlar 910220-0200**



**Figure 6. Fritzlar 910314-0200**

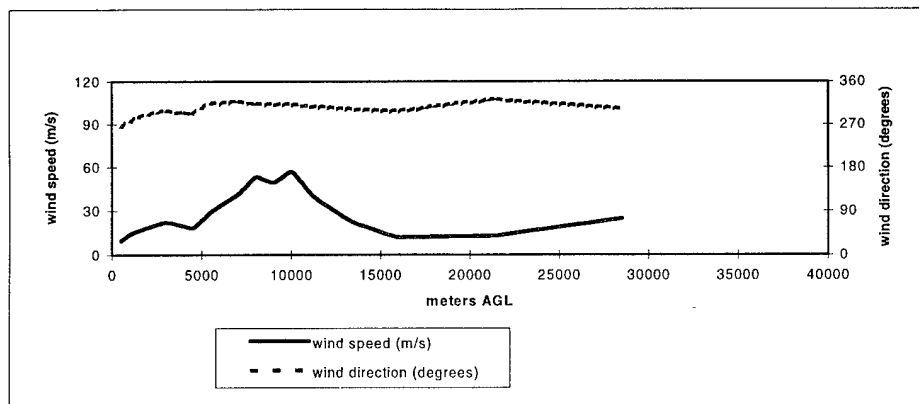


Figure 7. Fritzlar 910320-1100

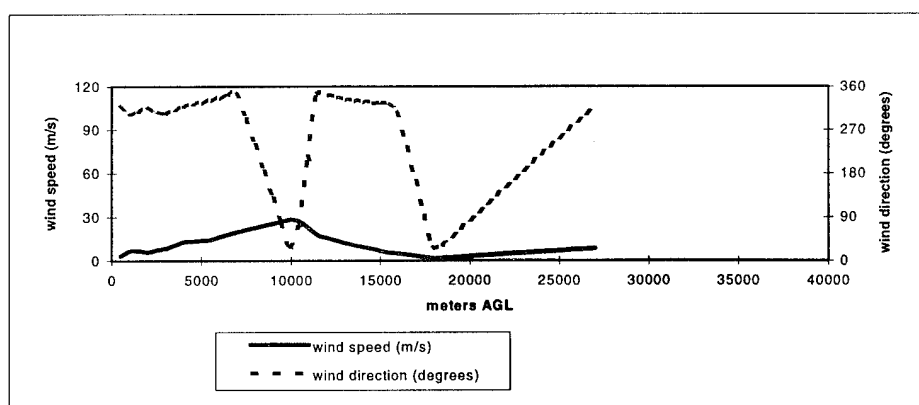


Figure 8. Fritzlar 910409-2200

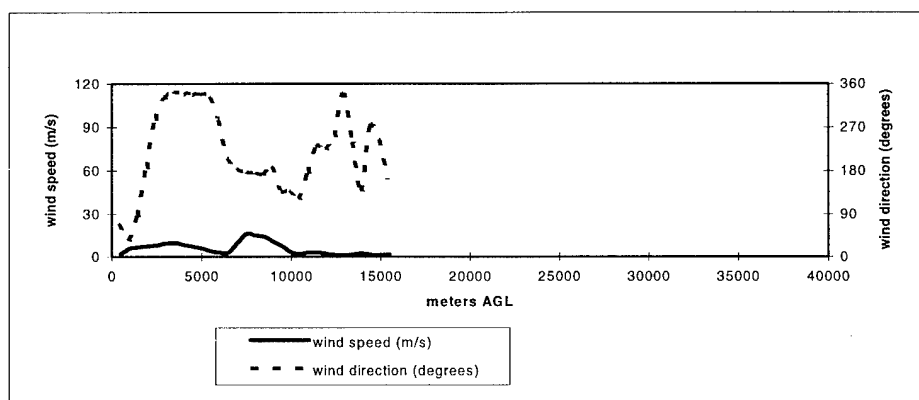


Figure 9. Fritzlar 910419-1000

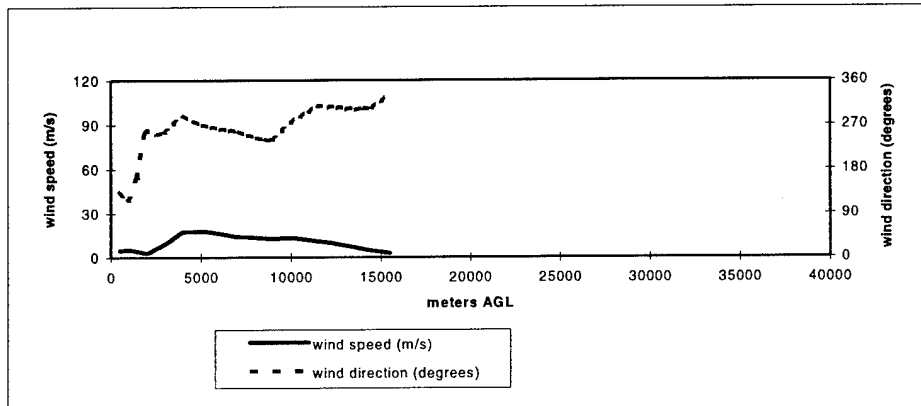


Figure 10. Fritzlar 910430-1300

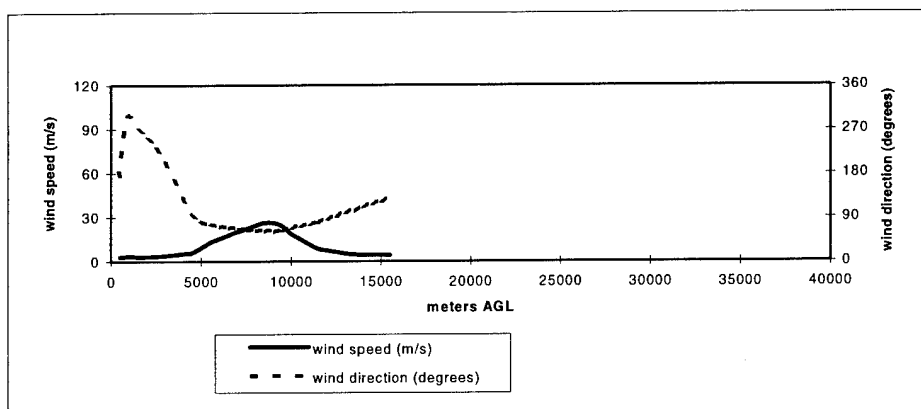


Figure 11. Fritzlar 910506-1000

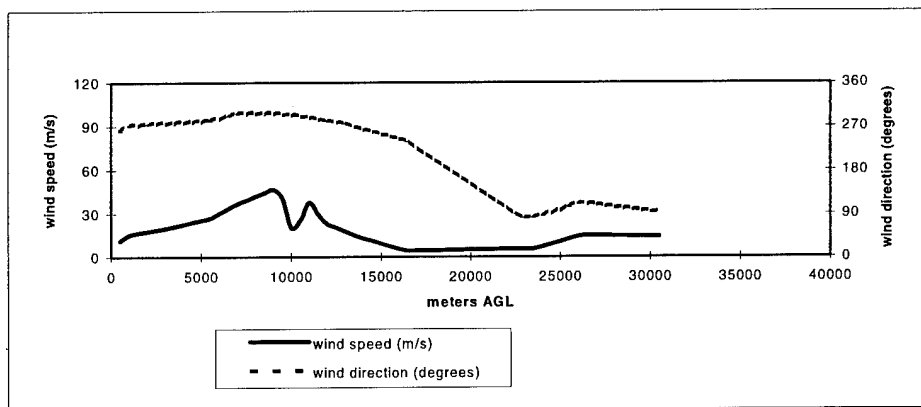
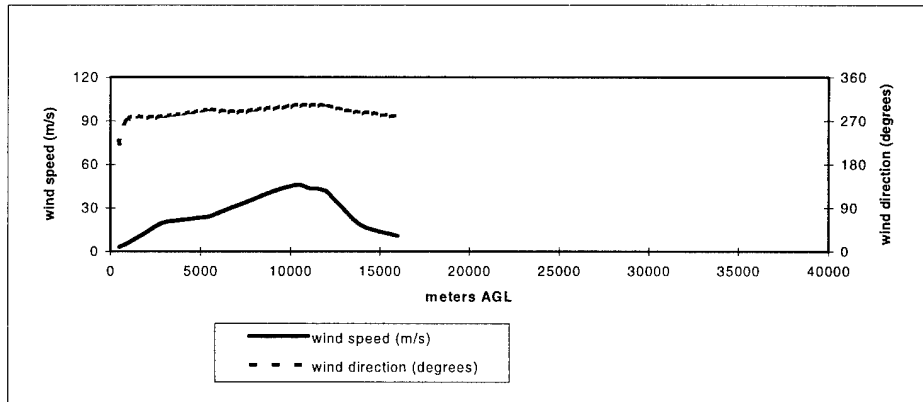
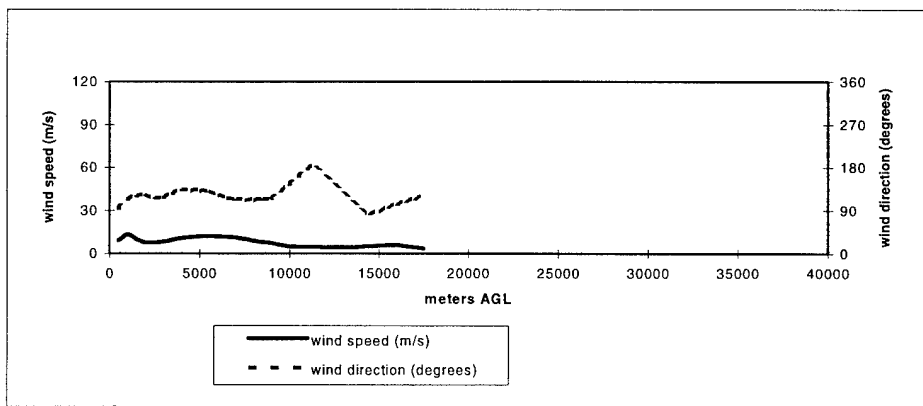


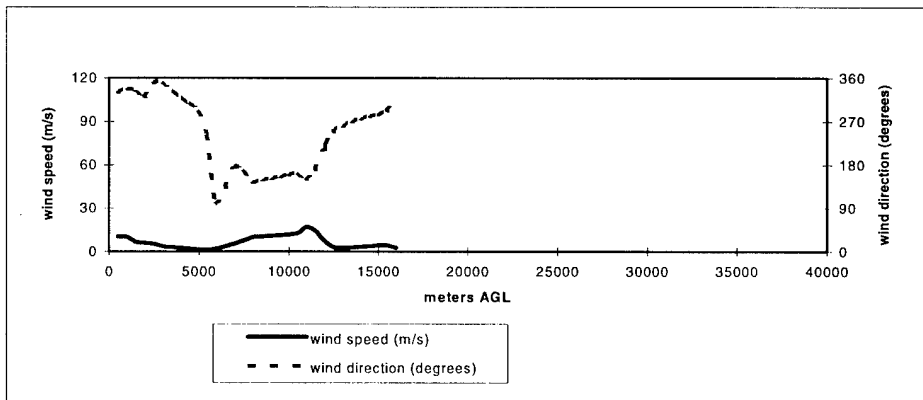
Figure 12. Fritzlar 910624-1000



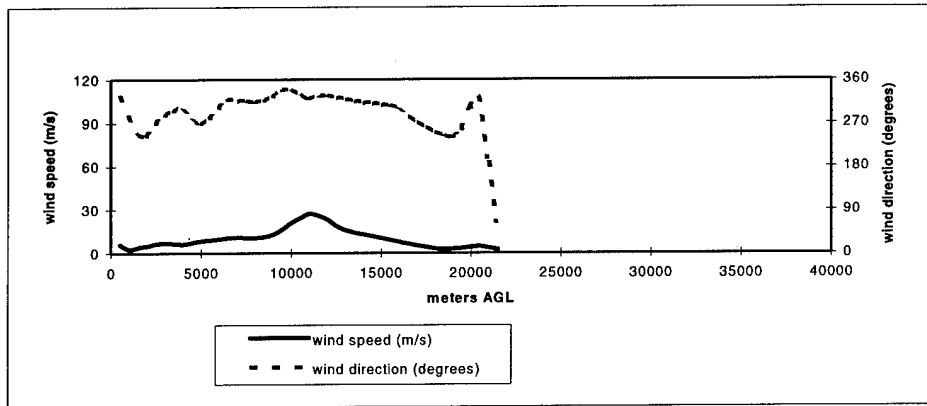
**Figure 13. Fritzlar 910624-2200**



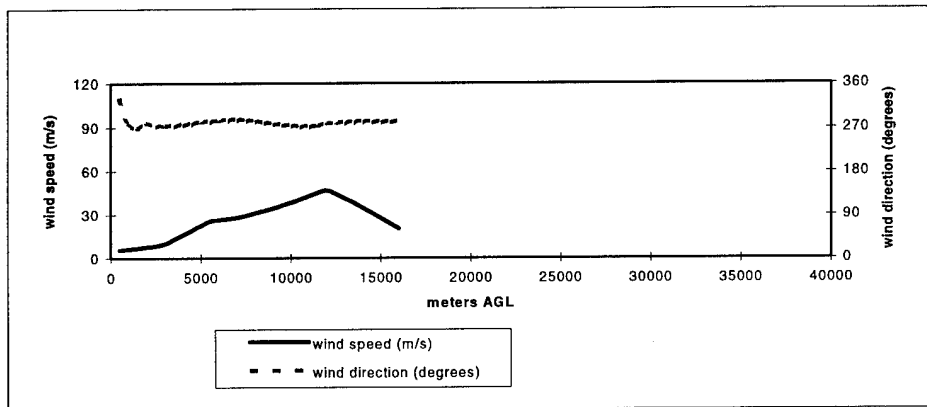
**Figure 14. Fritzlar 910705-0700**



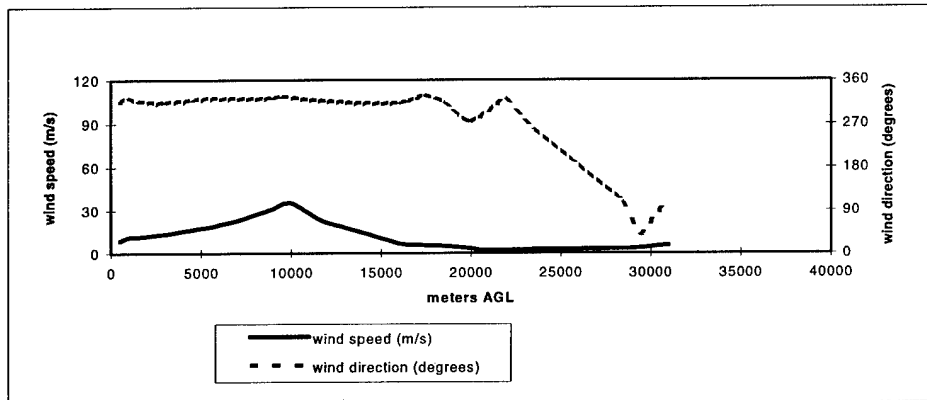
**Figure 15. Fritzlar 910802-0400**



**Figure 16. Fritzlar 910805-1900**



**Figure 17. Fritzlar 910812-2200**



**Figure 18. Fritzlar 910819-0400**



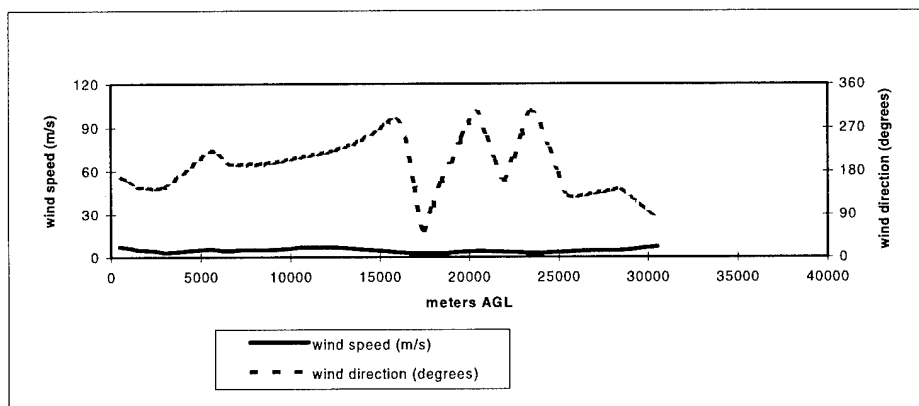


Figure 19. Fritzlar 910822-0400

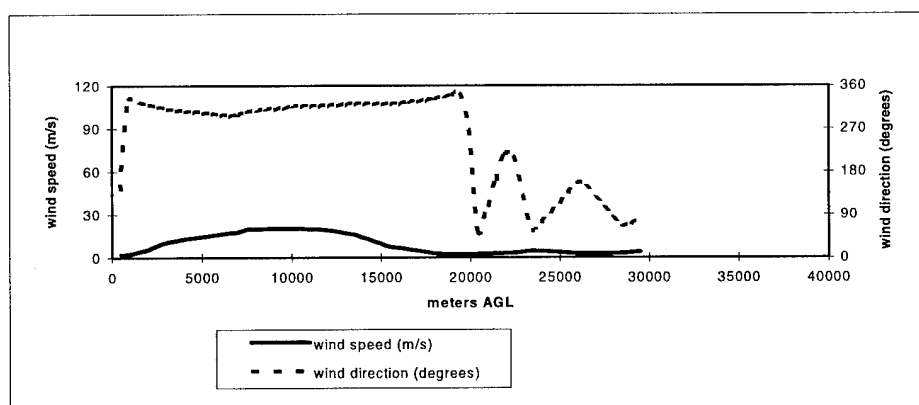


Figure 20. Fritzlar 910826-1000

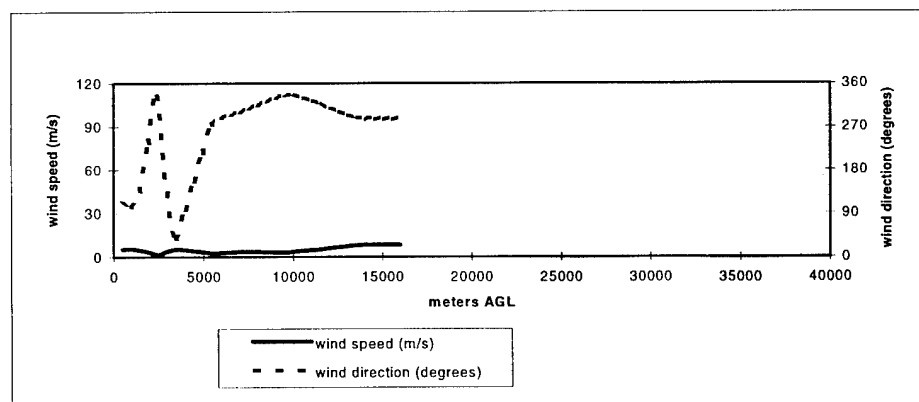
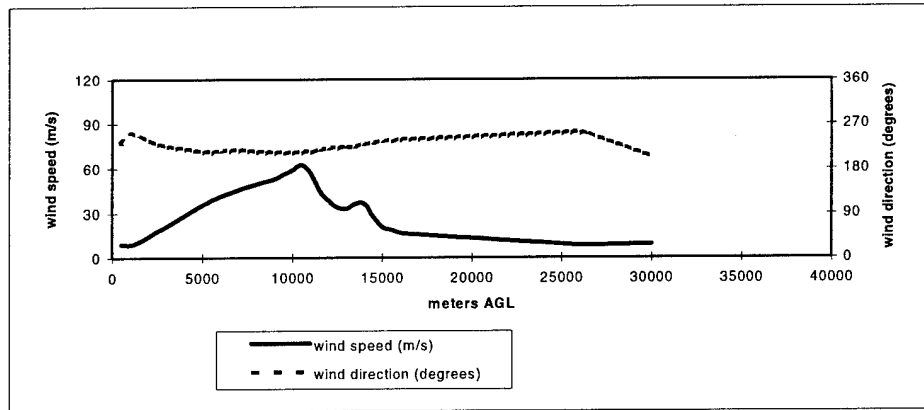
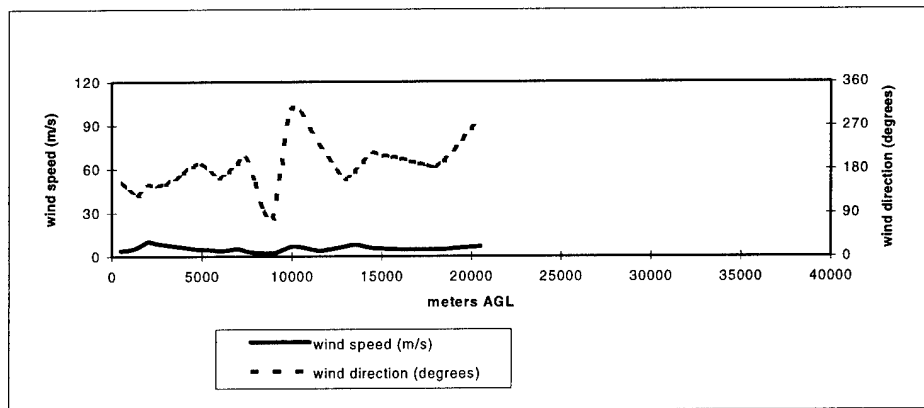


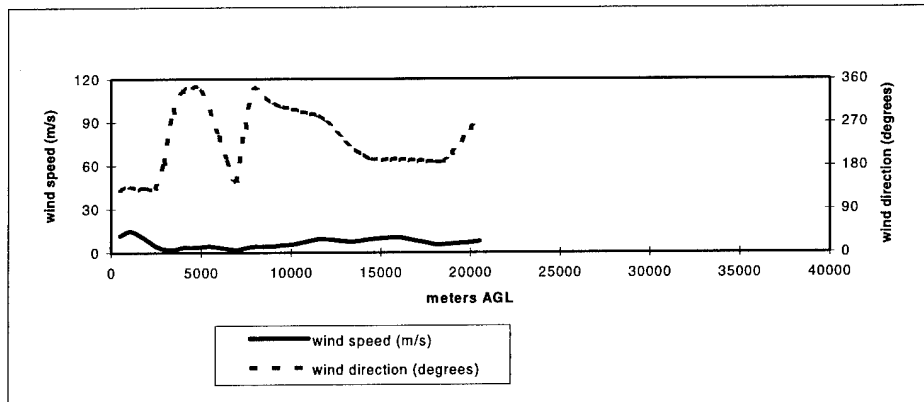
Figure 21. Fritzlar 910913-1000



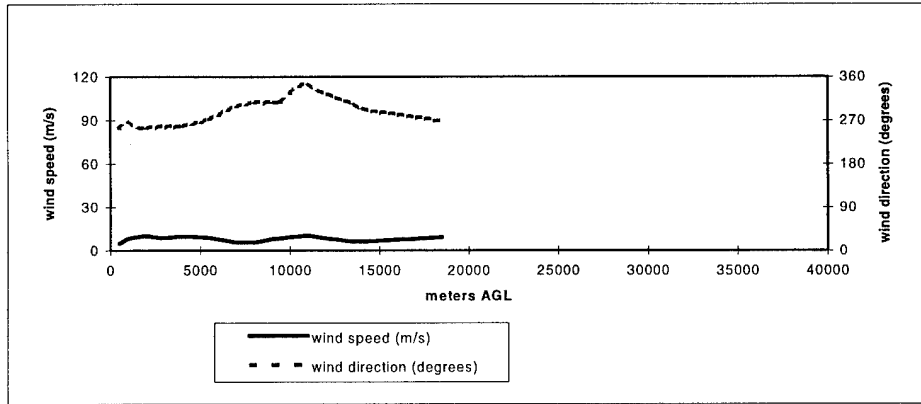
**Figure 22. Fritzlar 910930-0500**



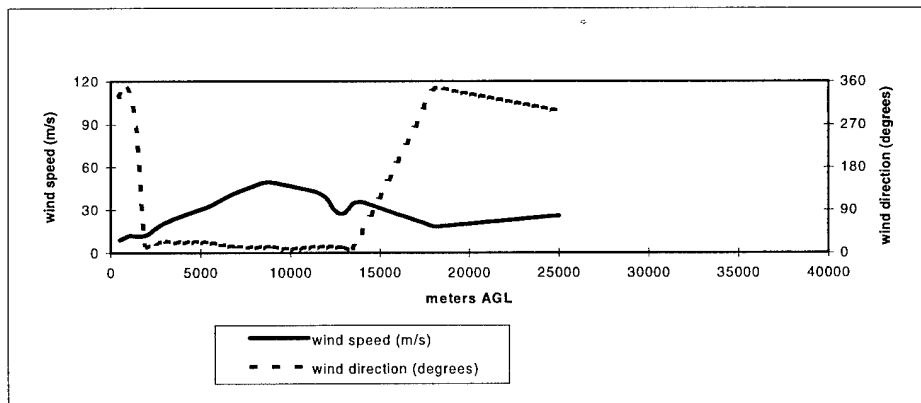
**Figure 23. Fritzlar 911009-0800**



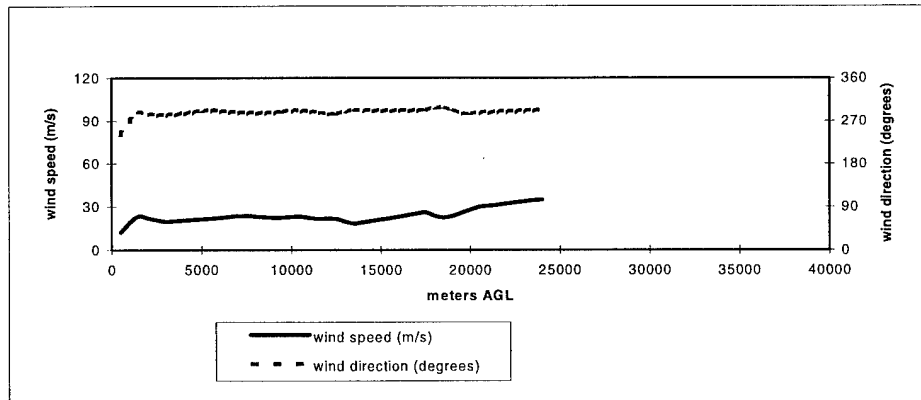
**Figure 24. Fritzlar 911011-0800**



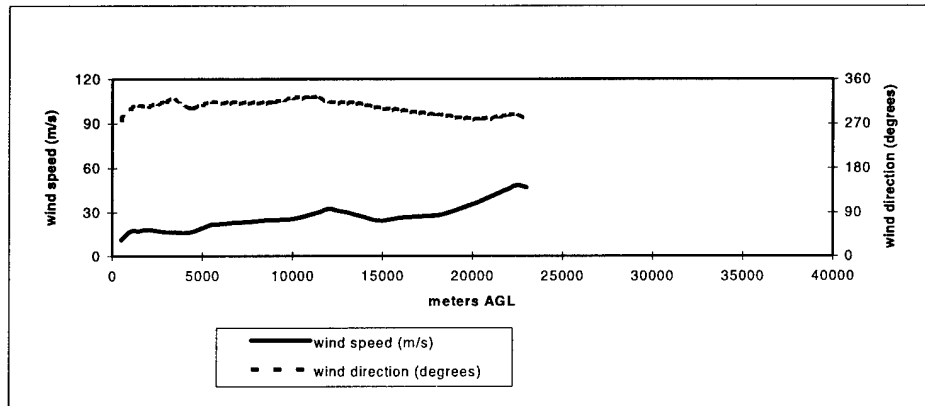
**Figure 25. Fritzlar 911016-0200**



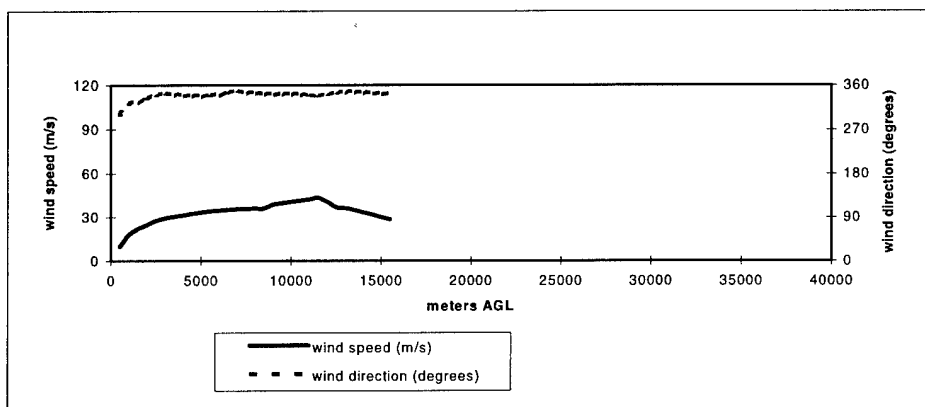
**Figure 26. Fritzlar 911206-1700**



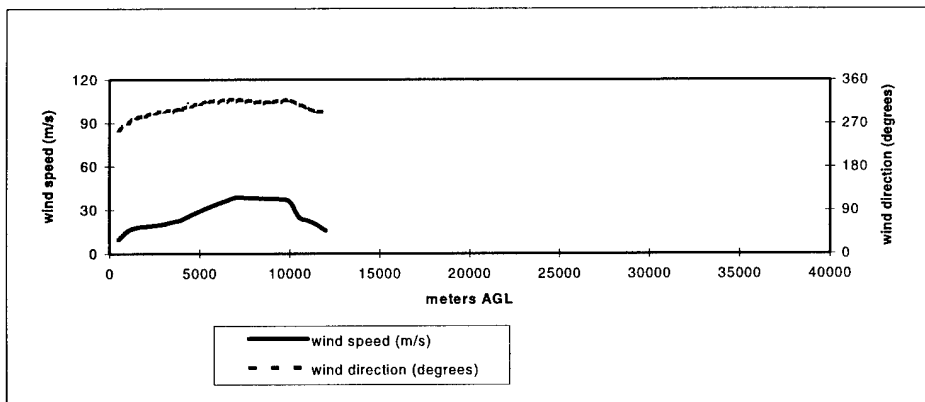
**Figure 27. Fritzlar 920102-1700**



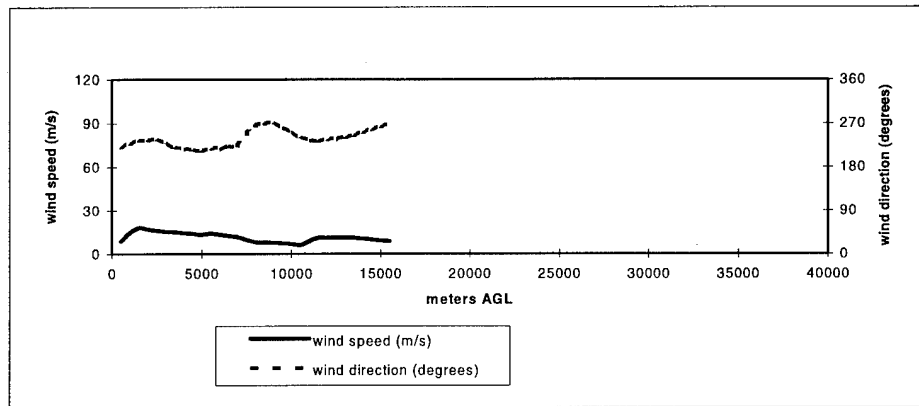
**Figure 28. Fritzlar 920106-1100**



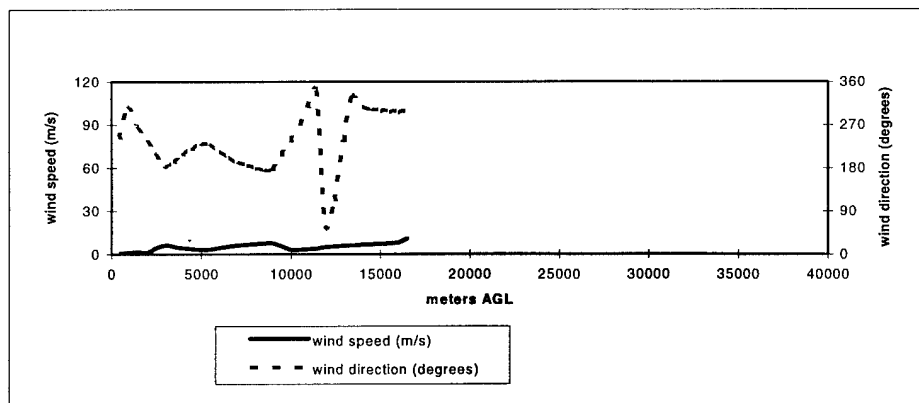
**Figure 29. Fritzlar 920205-1100**



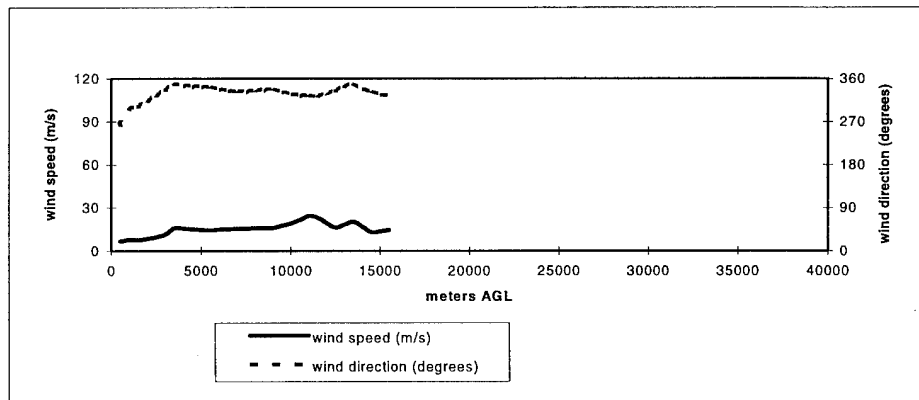
**Figure 30. Fritzlar 920214-1400**



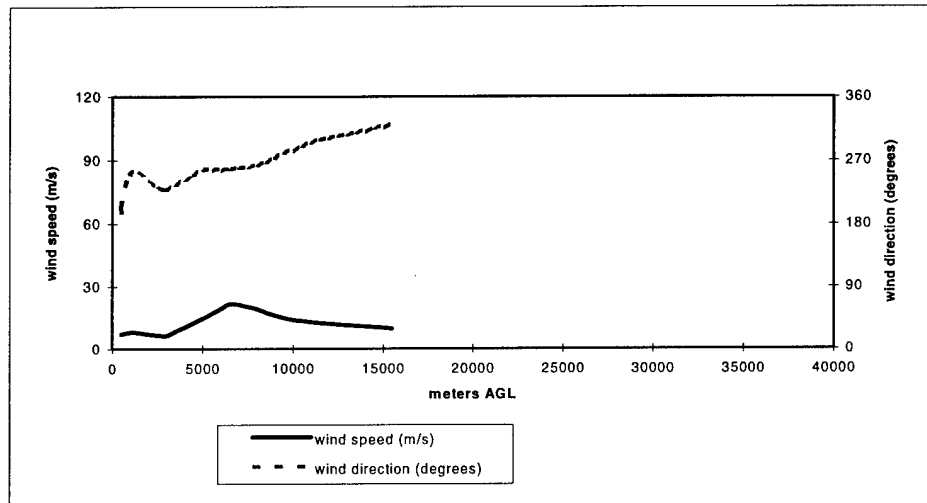
**Figure 31. Fritzlar 920301-2300**



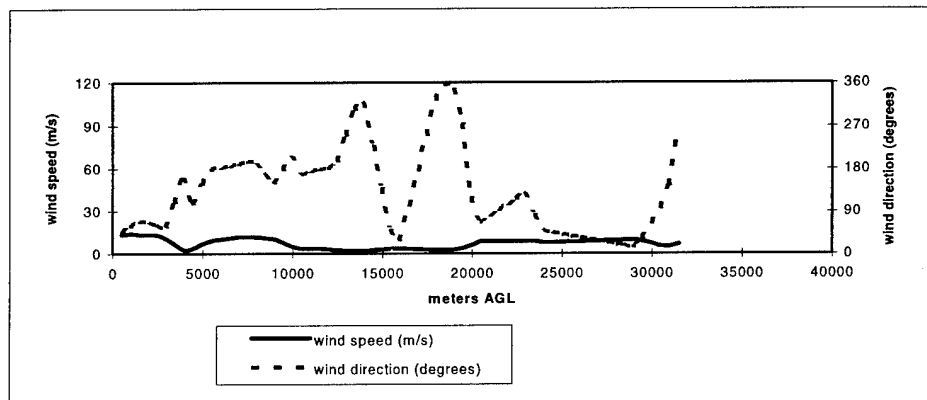
**Figure 32. Fritzlar 920309-0800**



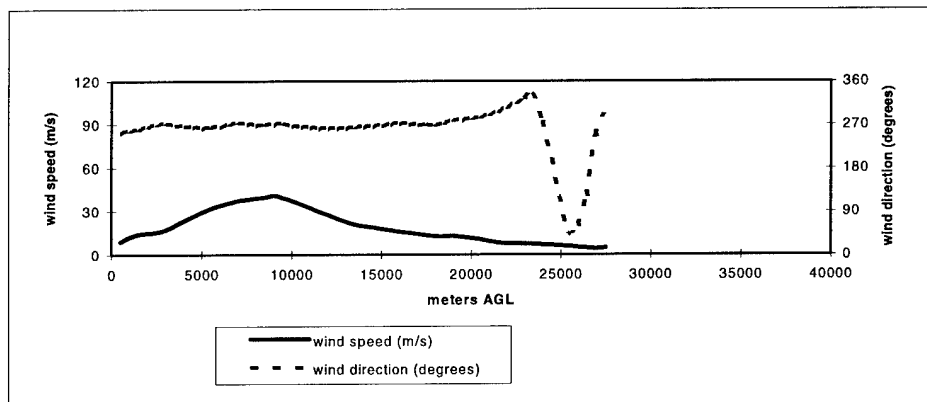
**Figure 33. Fritzlar 920317-1100**



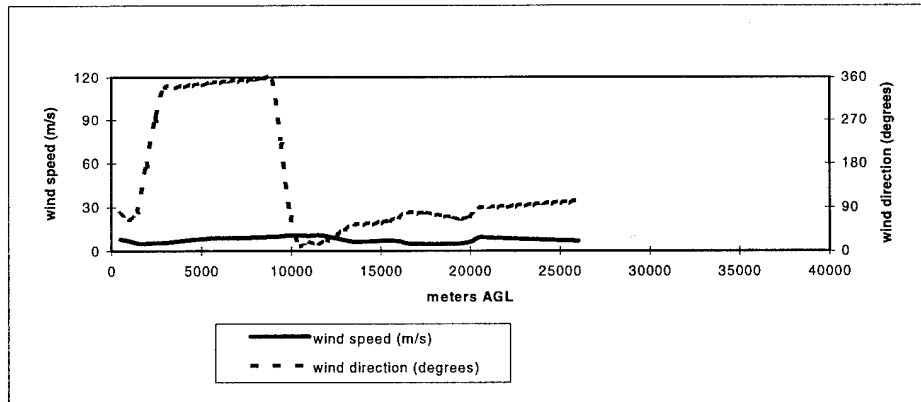
**Figure 34. Fritzlar 920323-1100**



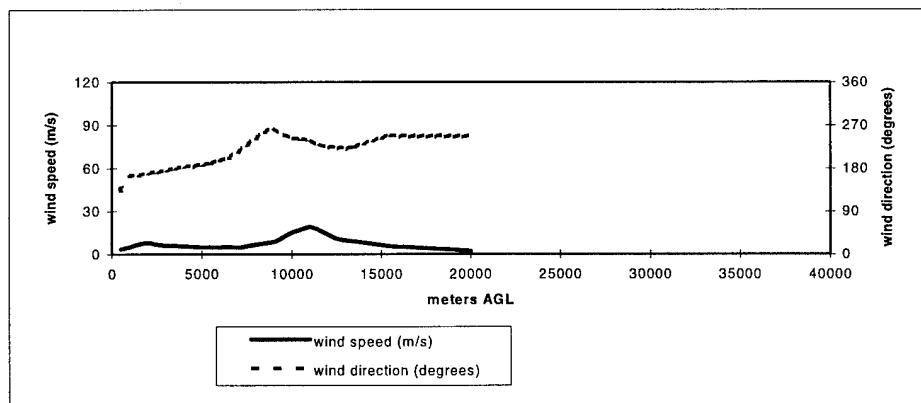
**Figure 35. Fritzlar 920324-1100**



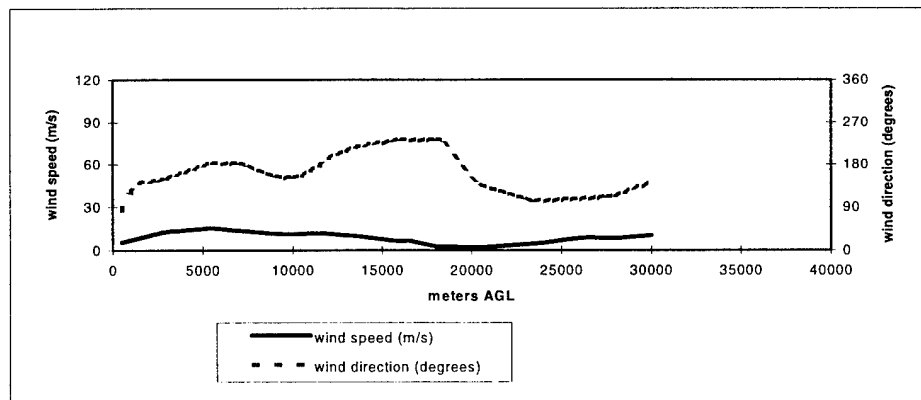
**Figure 36. Fritzlar 920427-1600**



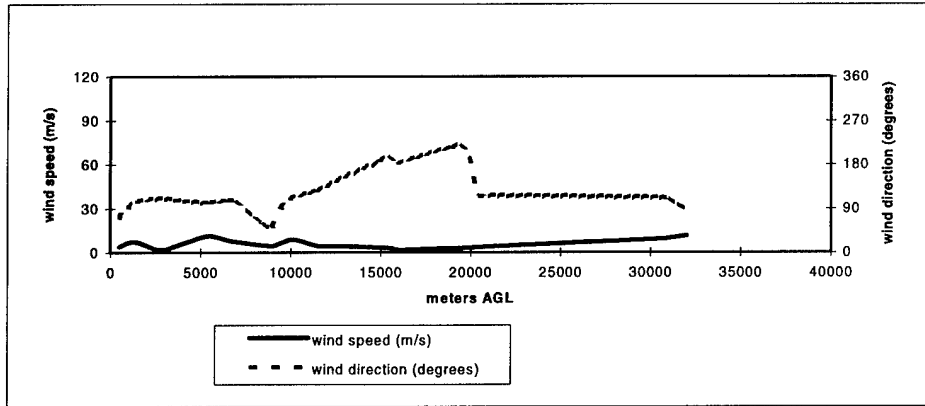
**Figure 37. Fritzlar 920526-0400**



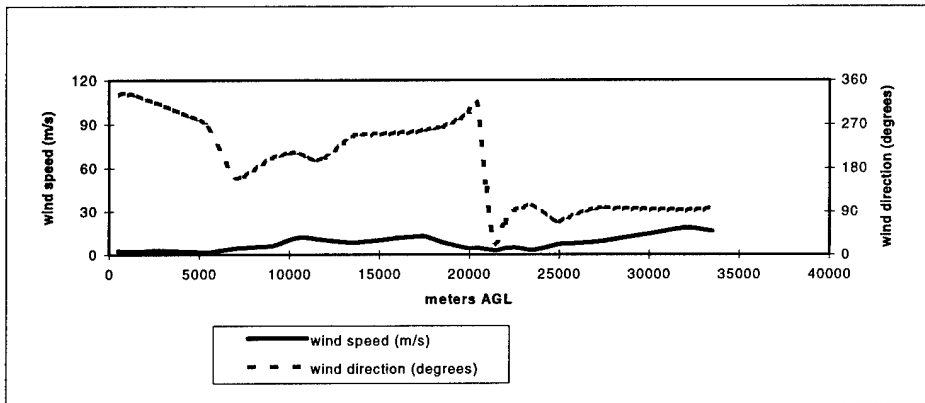
**Figure 38. Fritzlar 920602-0100**



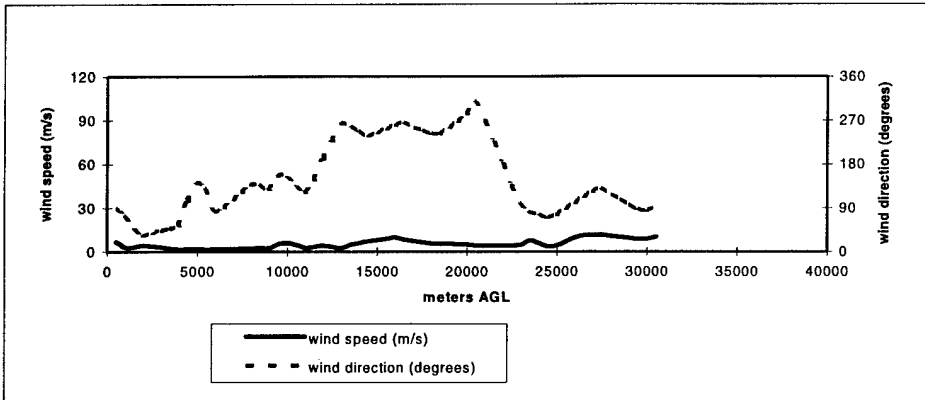
**Figure 39. Fritzlar 920602-1000**



**Figure 40. Fritzlar 920609-1000**

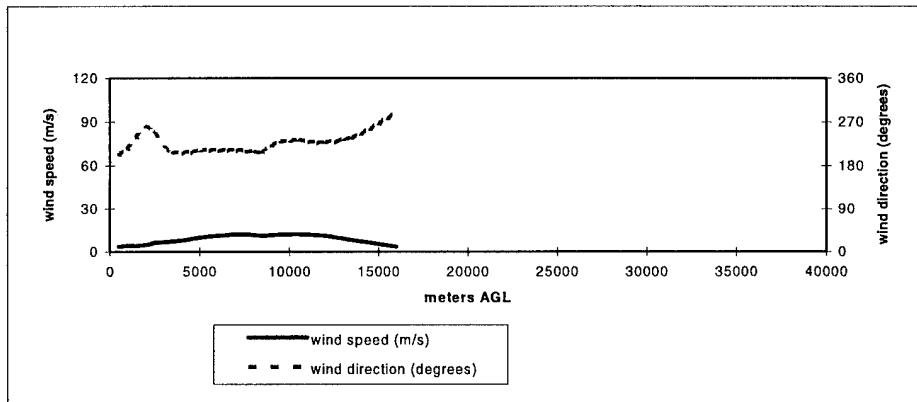


**Figure 41. Fritzlar 920624-0400**

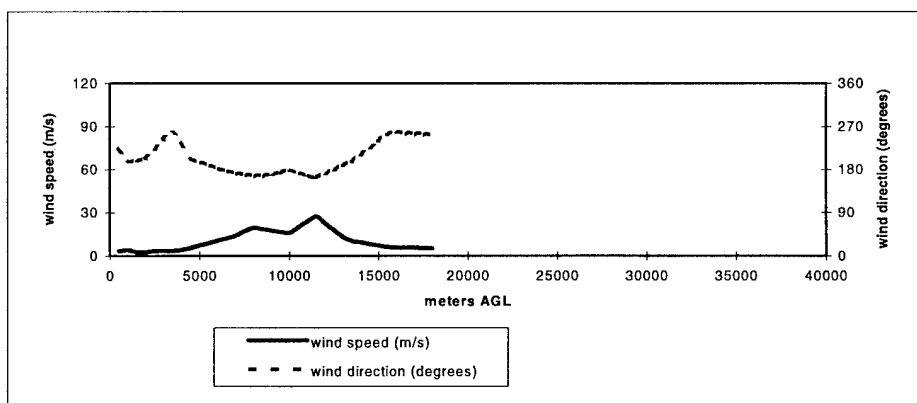


**Figure 42. Fritzlar 920625-0400**

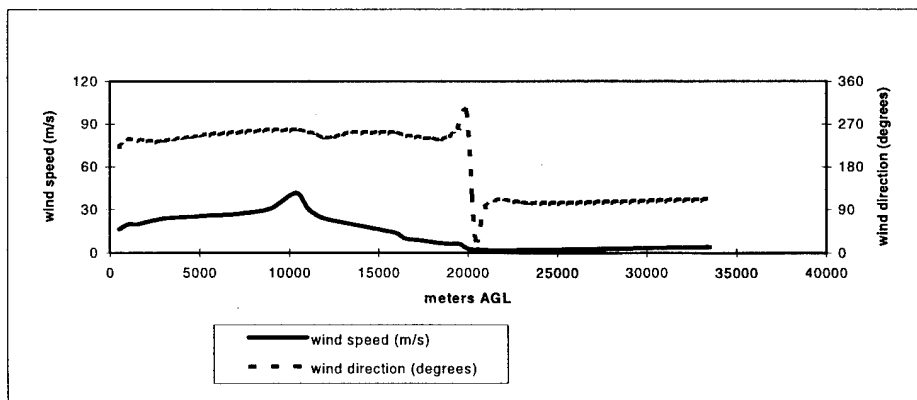




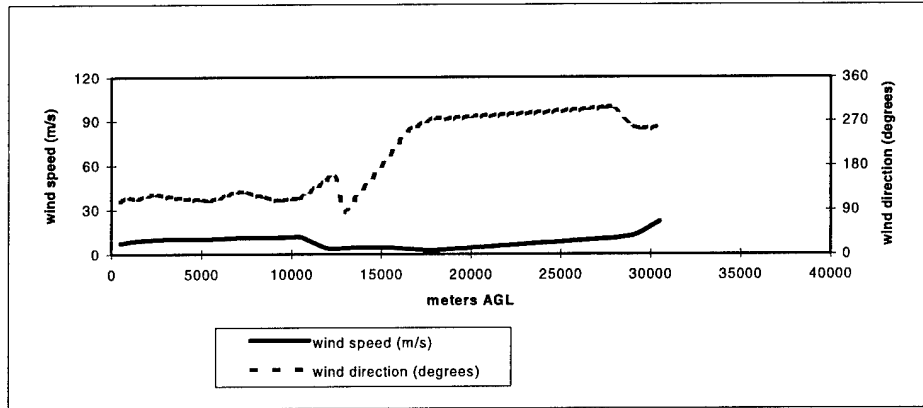
**Figure 43. Fritzlar 920630-1600**



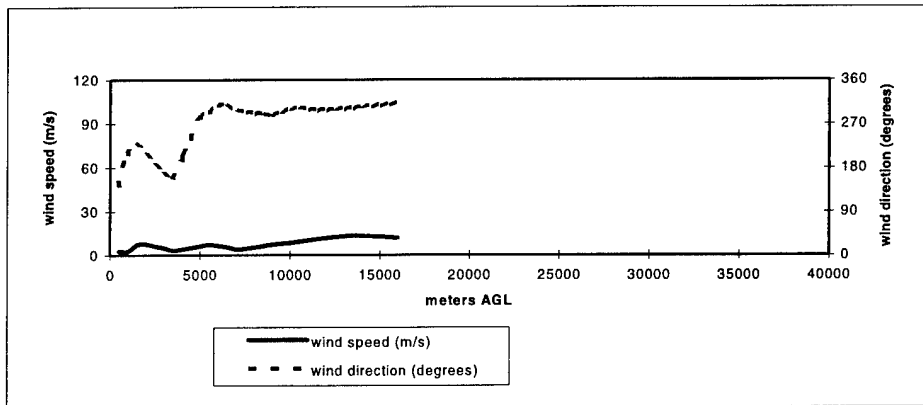
**Figure 44. Fritzlar 920710-0100**



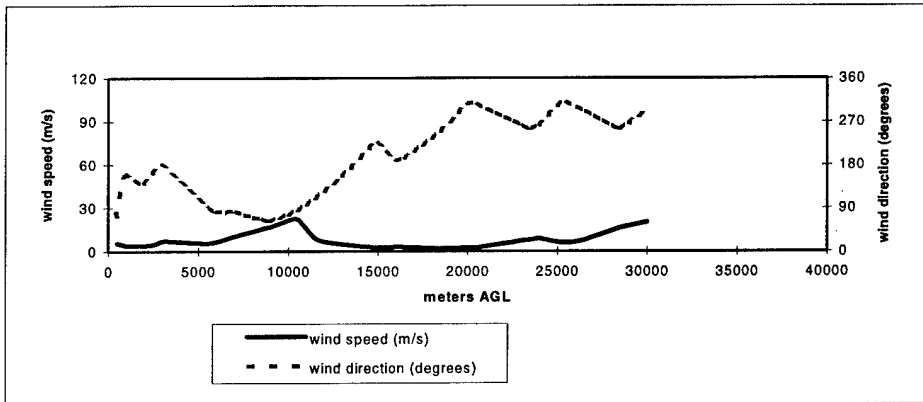
**Figure 45. Fritzlar 920812-2200**



**Figure 46. Fritzlar 920928-1100**



**Figure 47. Fritzlar 921001-2300**



**Figure 48. Fritzlar 921006-1100**

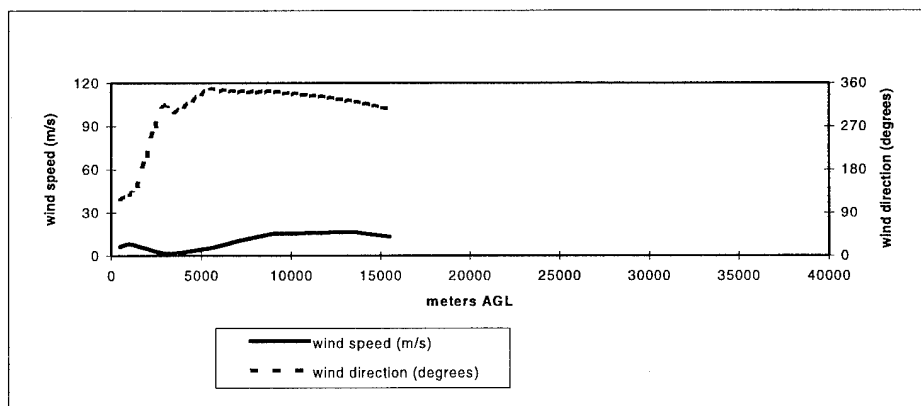


Figure 49. Fritzlar 921013-1100

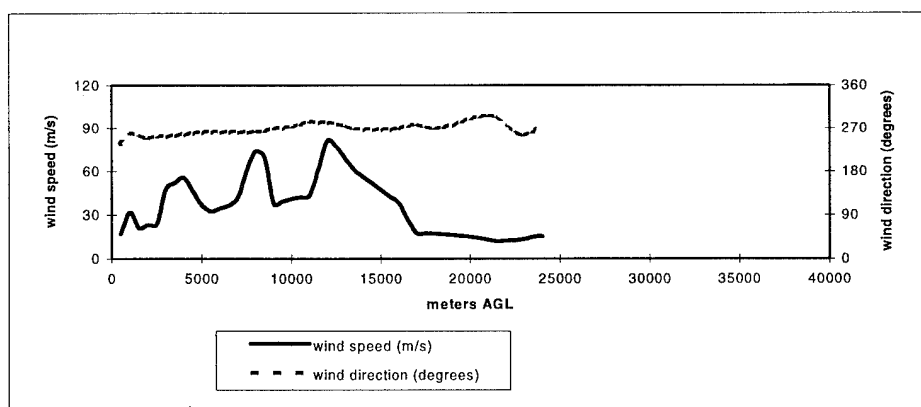


Figure 50. Fritzlar 921014-2300

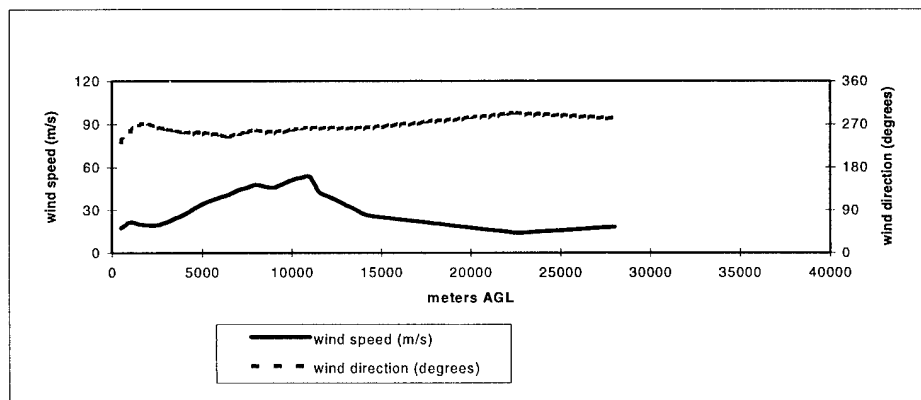
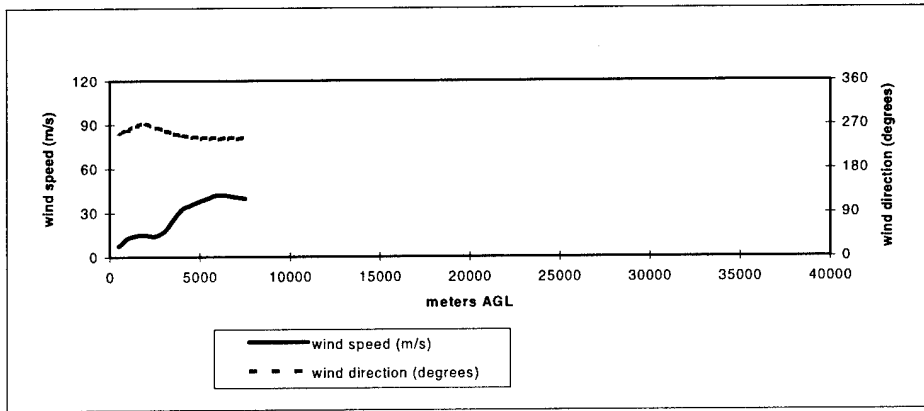
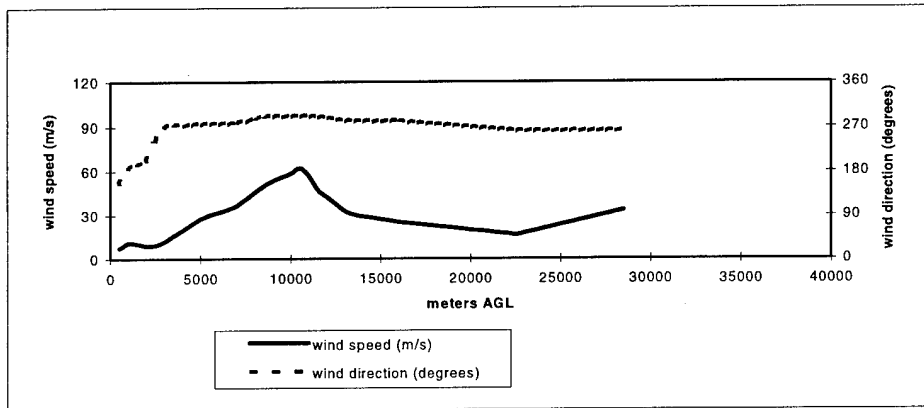


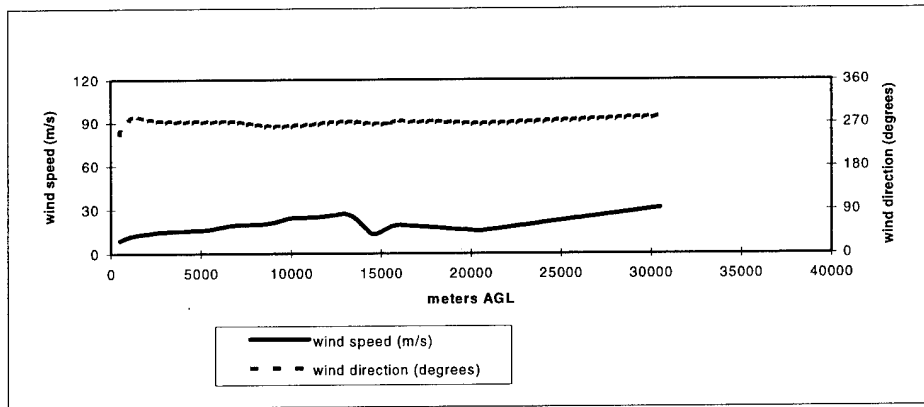
Figure 51. Fritzlar 921015-0500



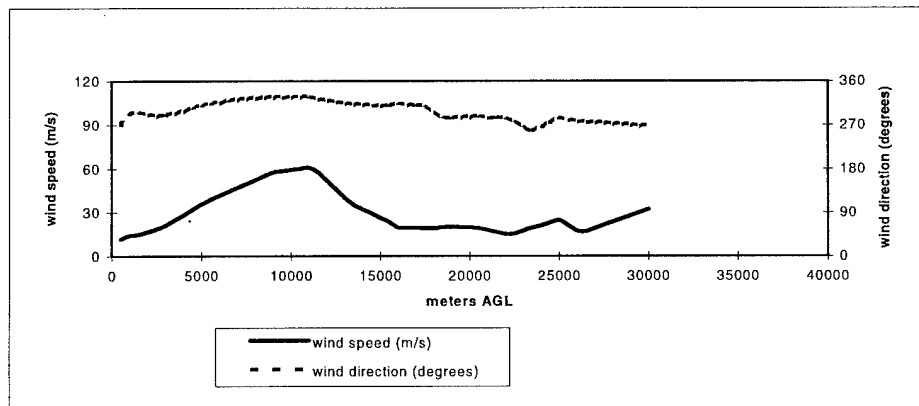
**Figure 52. Fritzlar 921015-1500**



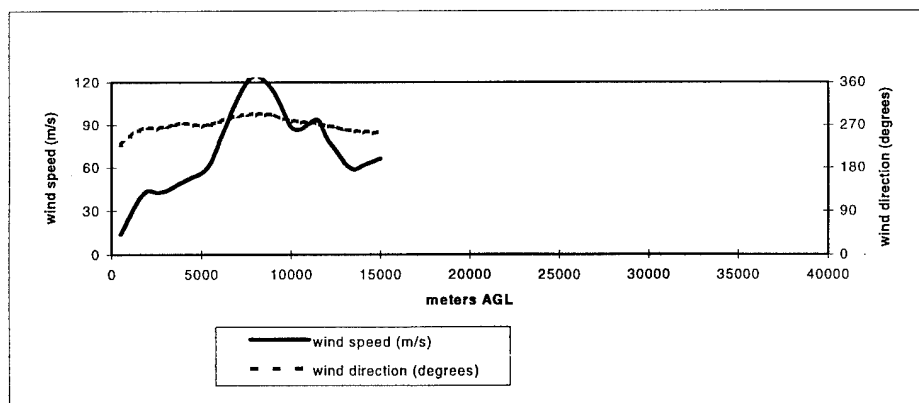
**Figure 53. Fritzlar 921027-1100**



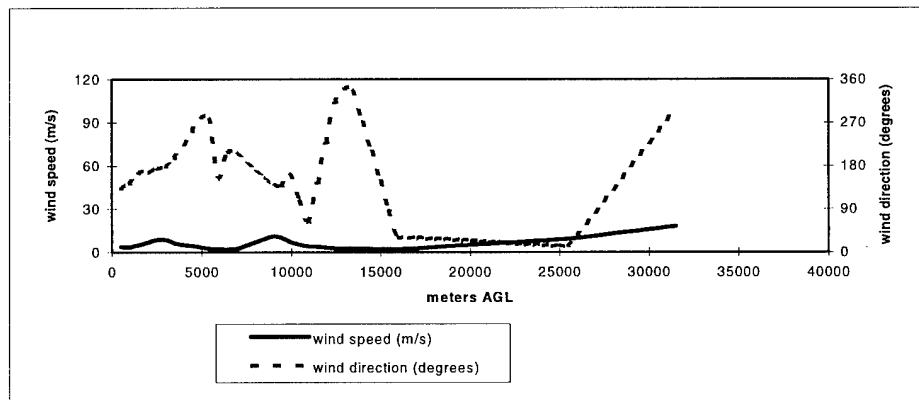
**Figure 54. Fritzlar 921103-1100**



**Figure 55. Fritzlar 921104-1100**



**Figure 56. Fritzlar 921125-1400**



**Figure 57. Fritzlar 921223-1100**

## 6.2 Trapani, Sicily

**Table 3. Table of Spread Distances (m), Trapani, Sicily**

Order Statistic	Intercept Altitude					
	5 km			10 km		
	Spread Distance	Date/Time	Figure No.	Spread Distance	Date/Time	Figure No.
Minimum	504.	920916-2300	112	412.	910826-1100	79
5th percentile	3488.	911101-0500	87	9354.	920131-1100	96
10th percentile	4952.	910812-1200	76	13136.	910103-1700	58
25th percentile	8378.	920116-1100	95	22679.	920201-1700	98
Median	13827.	920406-2300	102	37604.	910906-1100	81
75th percentile	20024.	921029-2300	118	52780.	920319-1100	100
90th percentile	26023.	921014-2300	113	68797.	911012-1100	83
95th percentile	30530.	911222-0500	92	80324.	921114-0500	119
Maximum	46370.	911019-1700	85	117780.	910503-1100	66
Number of Valid Profiles	2130			2113		

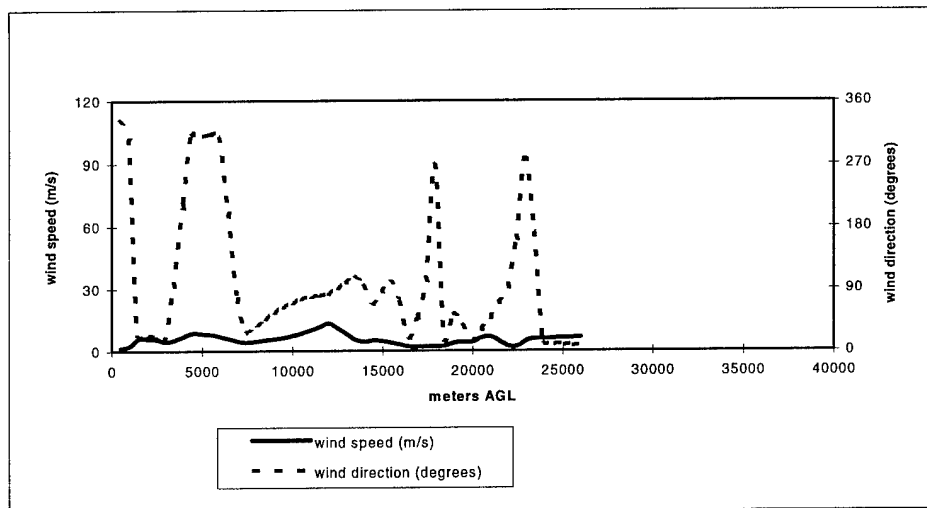
  

Order Statistic	Intercept Altitude					
	20 km			30 km		
	Spread Distance	Date/Time	Figure No.	Spread Distance	Date/Time	Figure No.
Minimum	4624.	910712-0500	74	1254.	910827-1100	80
5th percentile	19353.	920825-2300	110	18212.	920716-1100	107
10th percentile	27107.	920807-1700	109	28046.	910625-0500	72
25th percentile	42925.	910531-1700	70	46192.	910226-1700	61
Median	68459.	920403-2300	101	73327.	920210-1700	99
75th percentile	97102.	911129-1100	91	107564.	911024-1100	86
90th percentile	123370.	921119-2300	120	140122.	911105-1100	88
95th percentile	140008.	910427-0500	65	158544.	910419-2300	64
Maximum	209617.	921023-0500	116	219893.	911123-0500	90
Number of Valid Profiles	1853			1318		

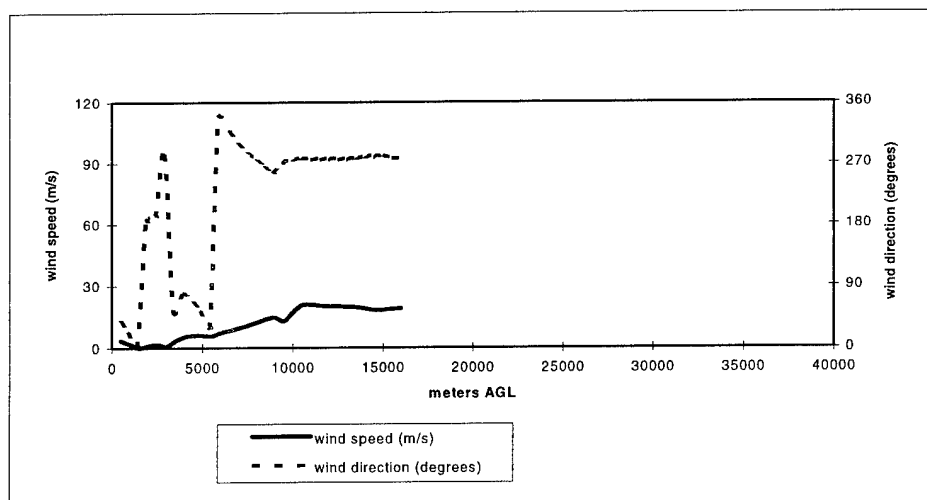
**Table 4. Table of Travel Distances (m), Trapani, Sicily**

Order Statistic	Intercept Altitude					
	5 km			10 km		
	Travel Distance	Date/Time	Figure No.	Travel Distance	Date/Time	Figure No.
Minimum	155.	920916-2300	112	220.	910826-1100	79
5th percentile	1194.	910124-0500	59	3037.	910813-0500	77
10th percentile	1706.	910531-1100	69	4269.	910318-1700	63
25th percentile	2887.	920420-2300	103	7336.	921212-1100	121
Median	4760.	920201-1100	97	12150.	920623-2300	106
75th percentile	6893.	911013-0500	84	16916.	911230-0500	93
90th percentile	8950.	910225-0500	60	22039.	921018-2300	115
95th percentile	10455.	911222-0500	92	25717.	910419-2300	64
Maximum	16029.	911019-1700	85	37666.	910503-1100	66
Number of Valid Profiles	2130			2113		

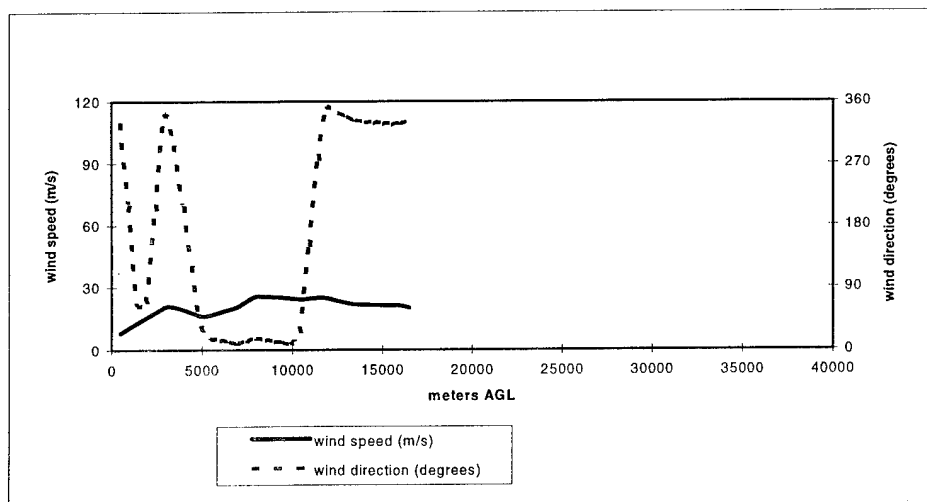
Order Statistic	Intercept Altitude					
	20 km			30 km		
	Travel Distance	Date/Time	Figure No.	Travel Distance	Date/Time	Figure No.
Minimum	656.	920504-0500	104	329.	910711-1700	73
5th percentile	5404.	920729-1700	108	5621.	910925-1100	82
10th percentile	7737.	910713-1100	75	7987.	910821-2300	78
25th percentile	12413.	910609-2300	71	13183.	920829-1700	111
Median	19892.	910513-2300	68	20643.	920520-2300	105
75th percentile	28063.	920104-1700	94	29302.	910312-2300	62
90th percentile	35759.	921017-1600	114	37460.	921026-2300	117
95th percentile	41052.	910509-2300	67	42391.	911120-1100	89
Maximum	60138.	921023-0500	116	61144.	921023-0500	116
Number of Valid Profiles	1853			1318		



**Figure 58. Trapani 910103-1700**

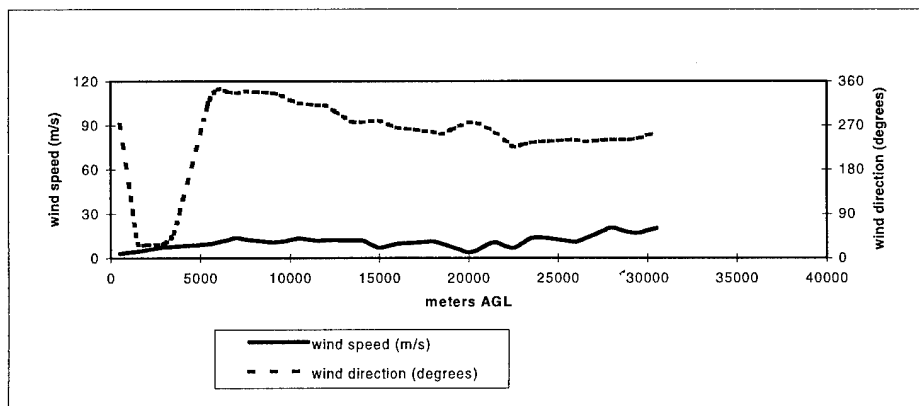


**Figure 59. Trapani 910124-0500**

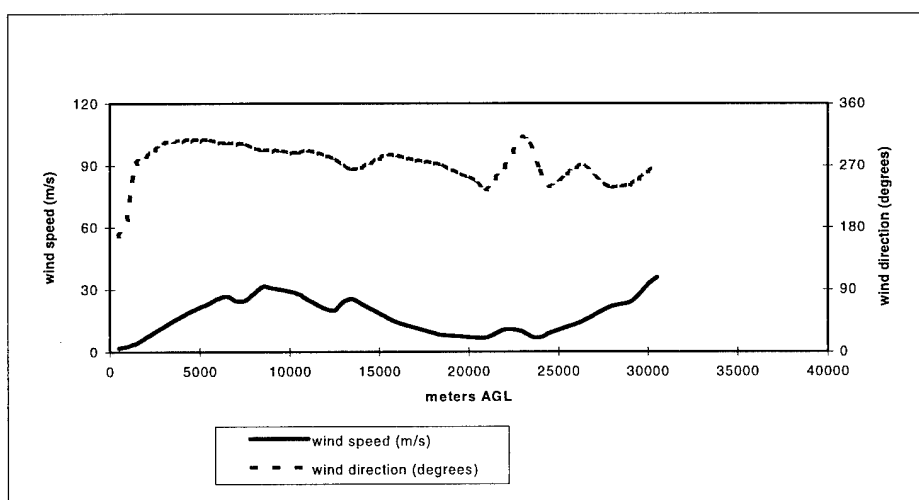


**Figure 60. Trapani 910225-0500**

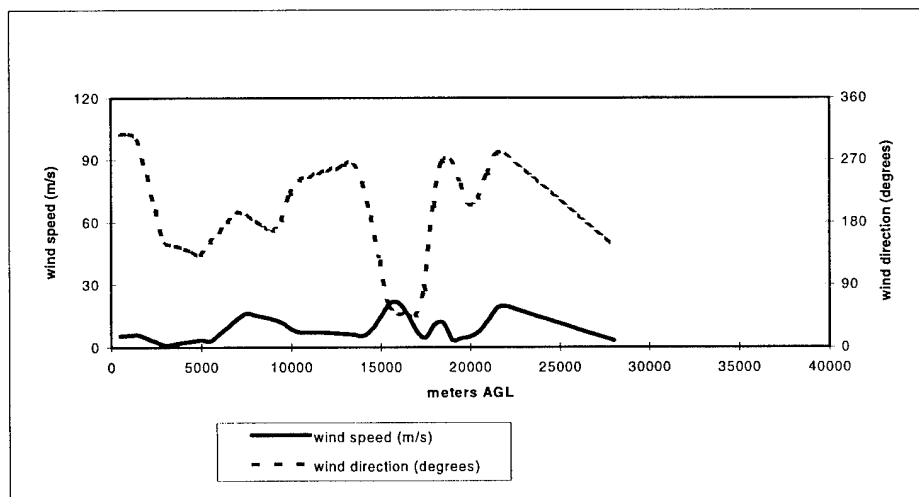




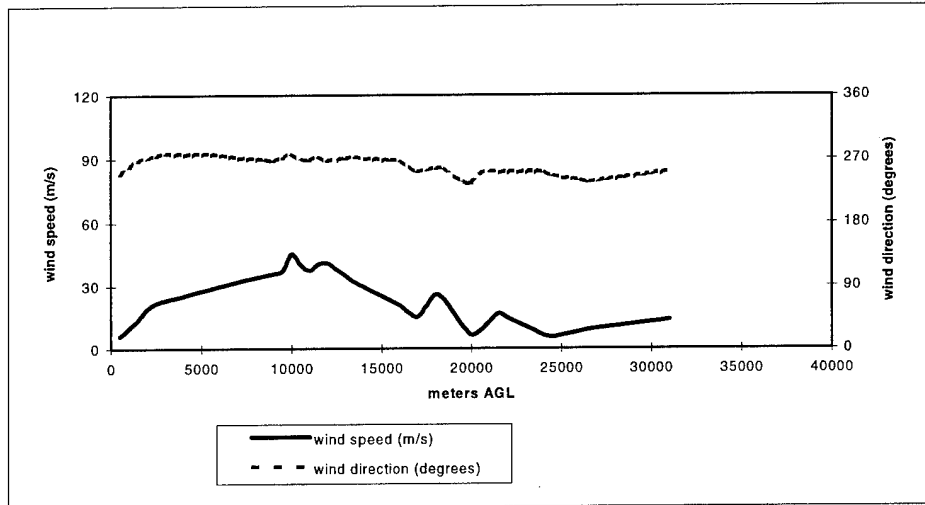
**Figure 61. Trapani 910226-1700**



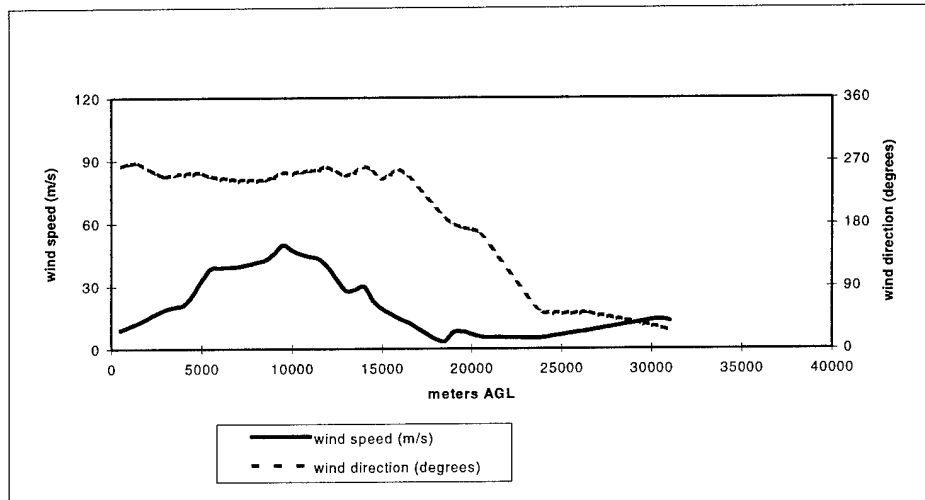
**Figure 62. Trapani 910312-2300**



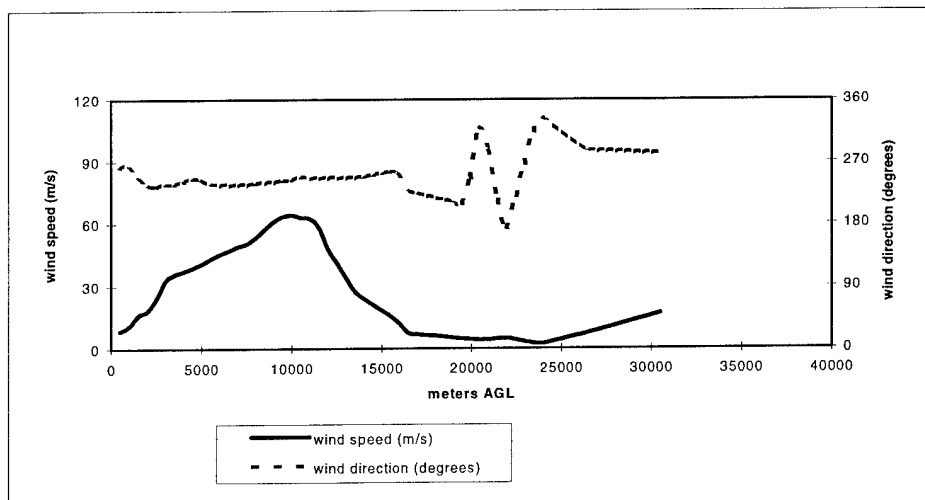
**Figure 63. Trapani 910318-1700**



**Figure 64. Trapani 910419-2300**



**Figure 65. Trapani 910427-0500**



**Figure 66. Trapani 910503-1100**

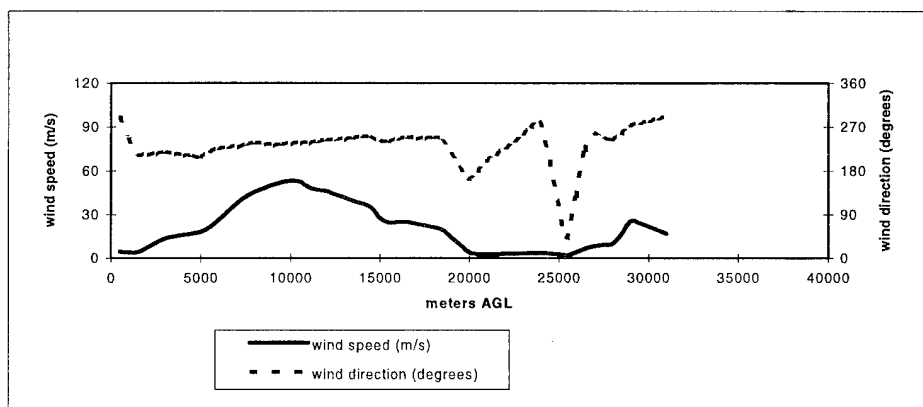


Figure 67. Trapani 910509-2300

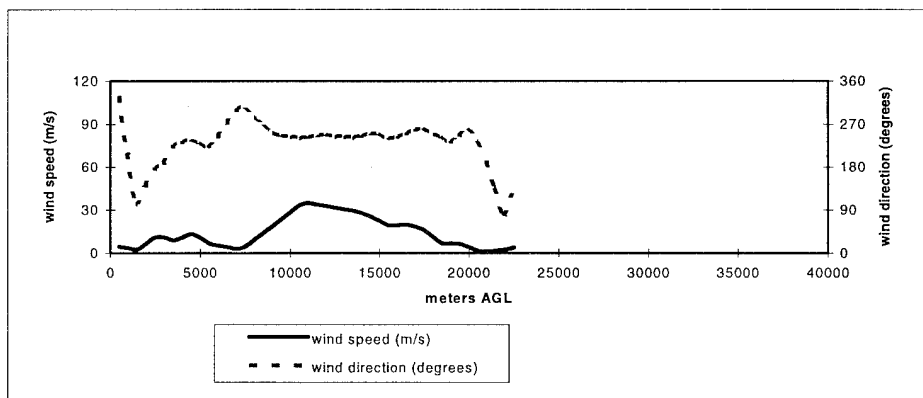


Figure 68. Trapani 910513-2300

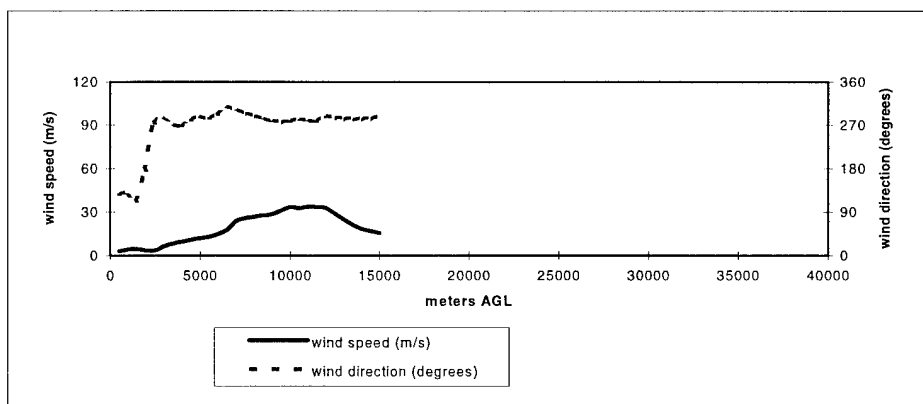
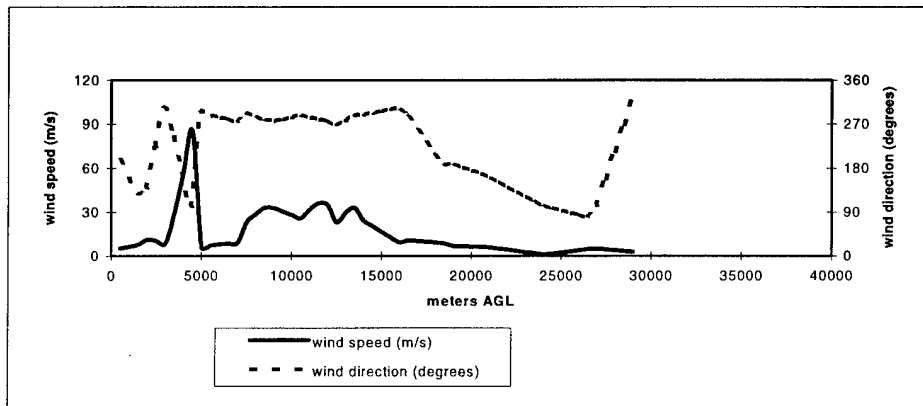
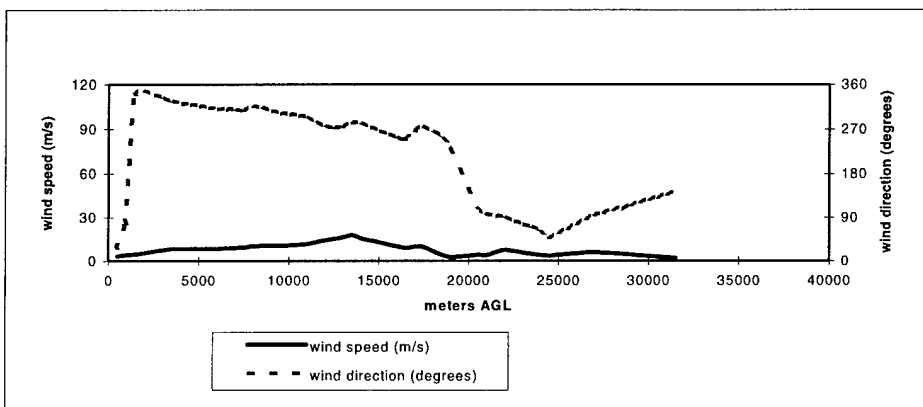


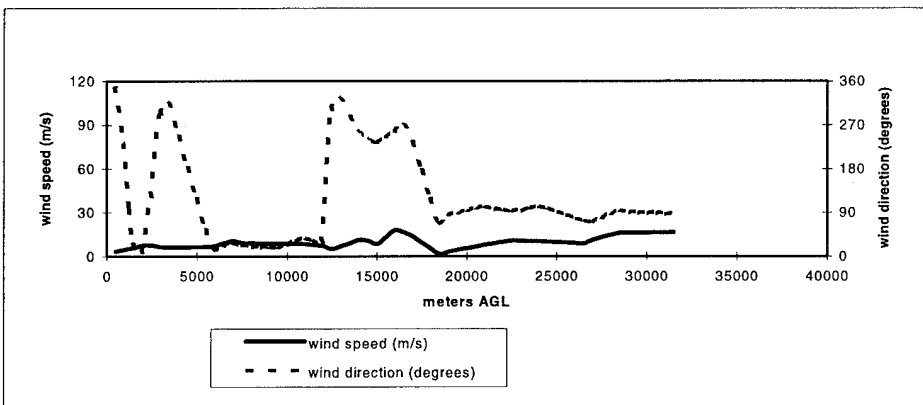
Figure 69. Trapani 910531-1100



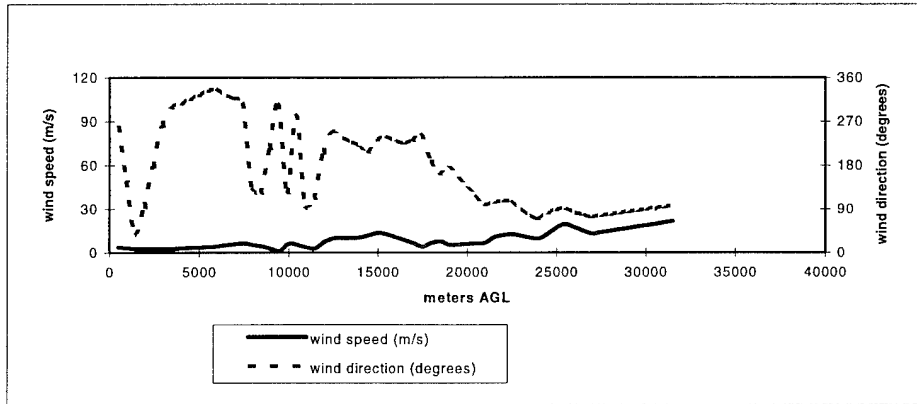
**Figure 70. Trapani 910531-1700**



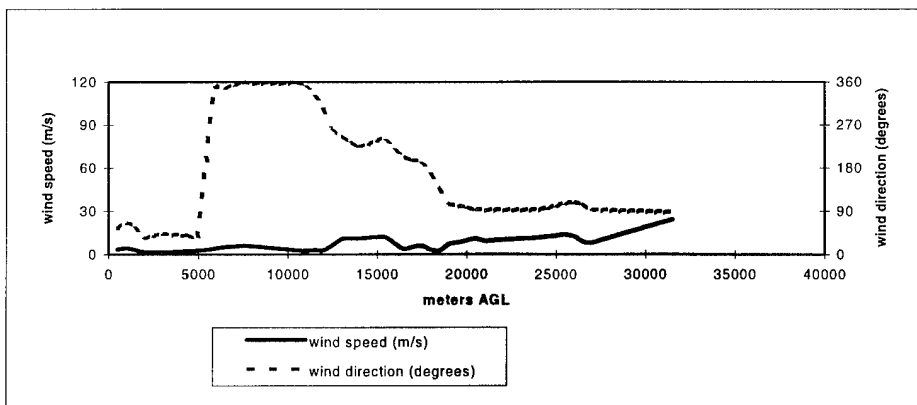
**Figure 71. Trapani 910609-2300**



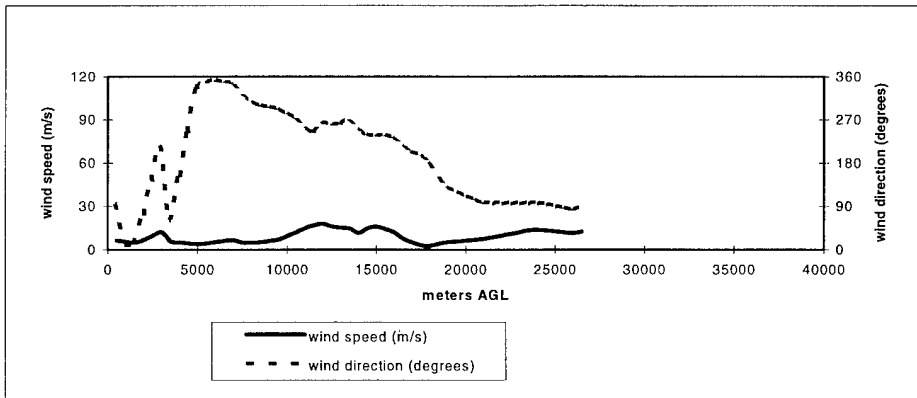
**Figure 72. Trapani 910625-0500**



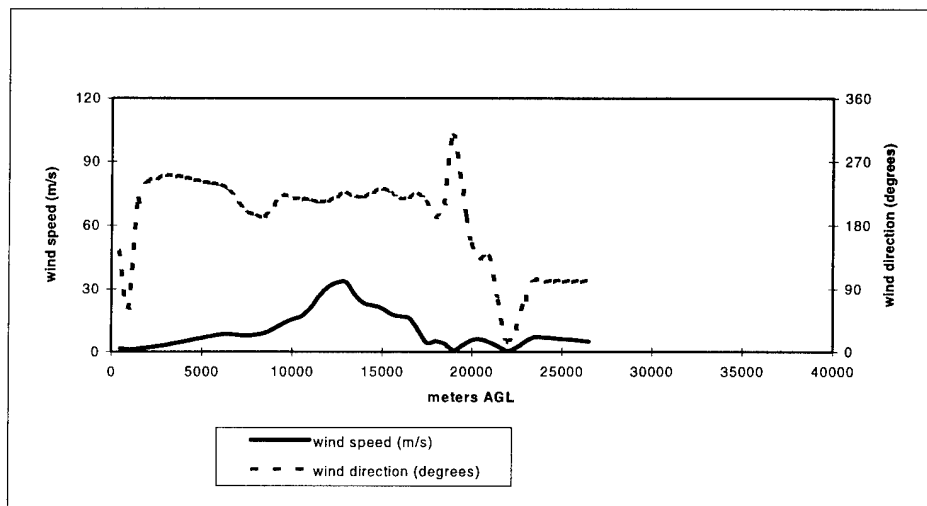
**Figure 73. Trapani 910711-1700**



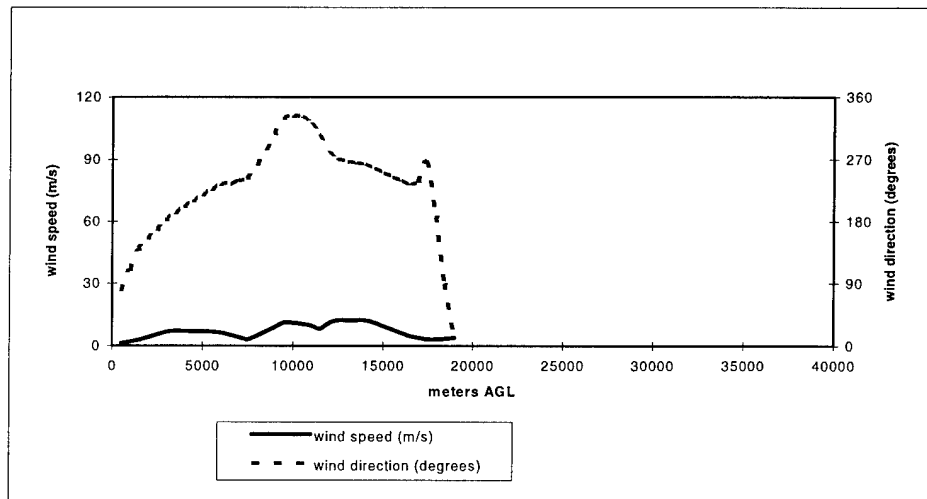
**Figure 74. Trapani 910712-0500**



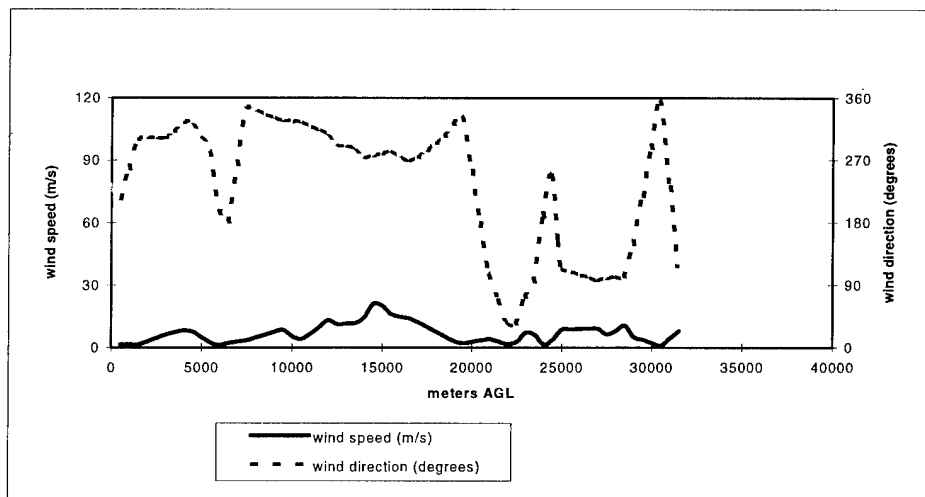
**Figure 75. Trapani 910713-1100**



**Figure 76. Trapani 910812-1200**



**Figure 77. Trapani 910813-0500**



**Figure 78. Trapani 910821-2300**

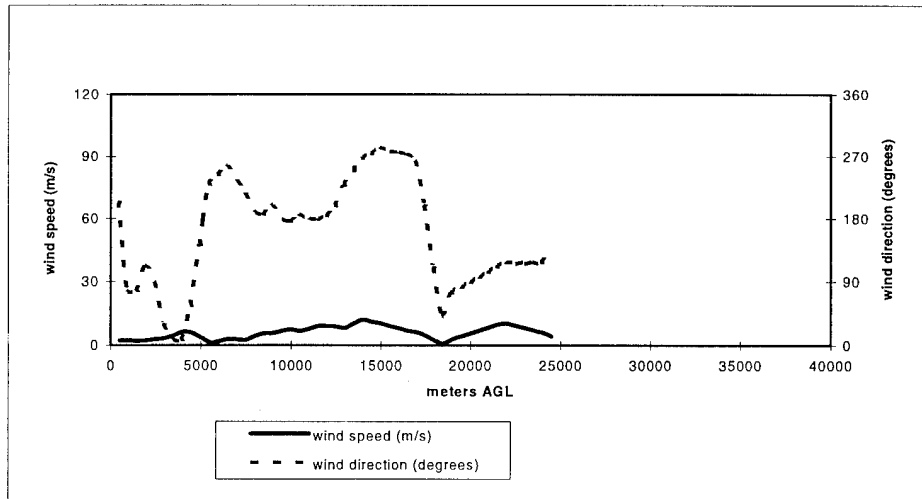


Figure 79. Trapani 910826-1100

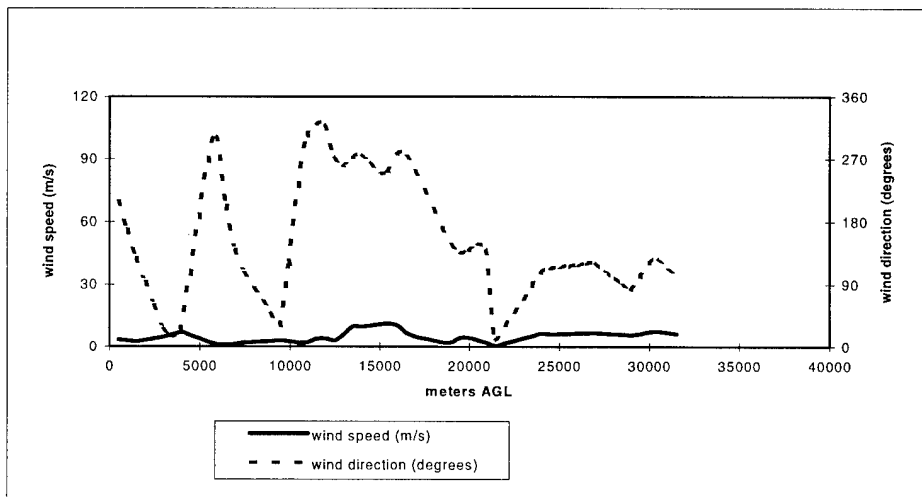


Figure 80. Trapani 910827-1100

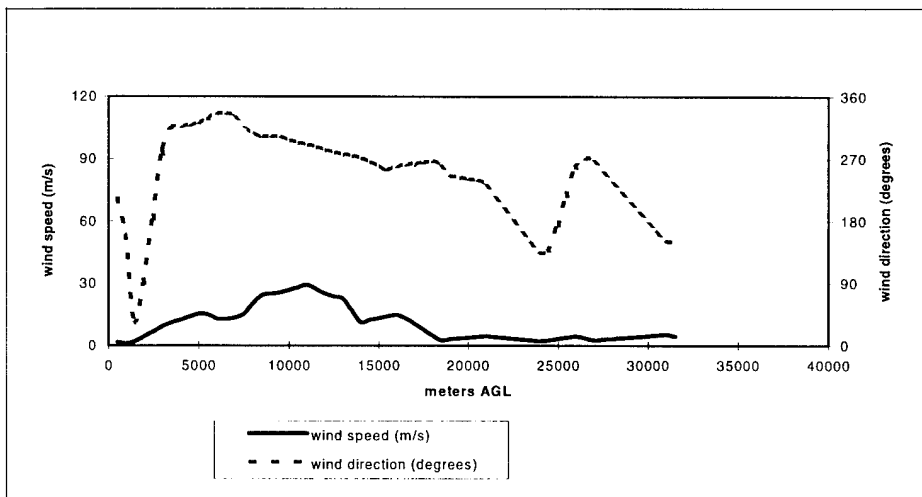


Figure 81. Trapani 910906-1100

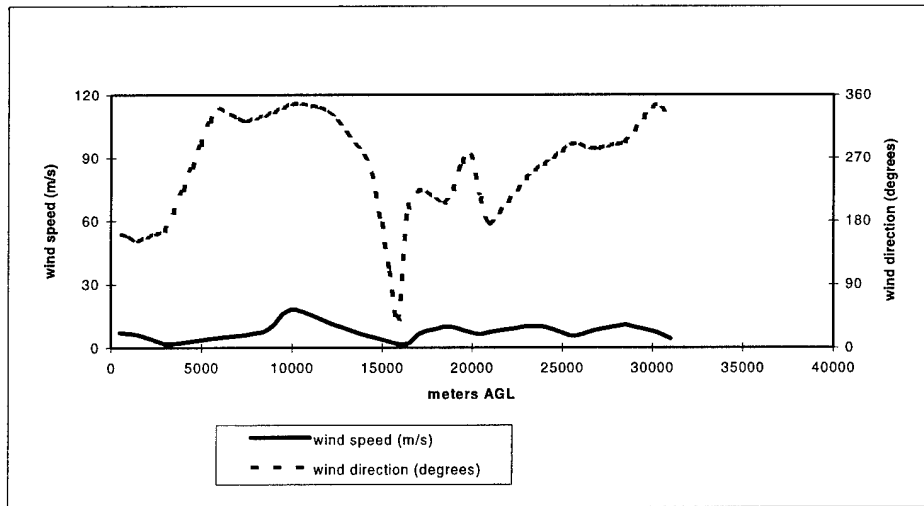


Figure 82. Trapani 910925-1100

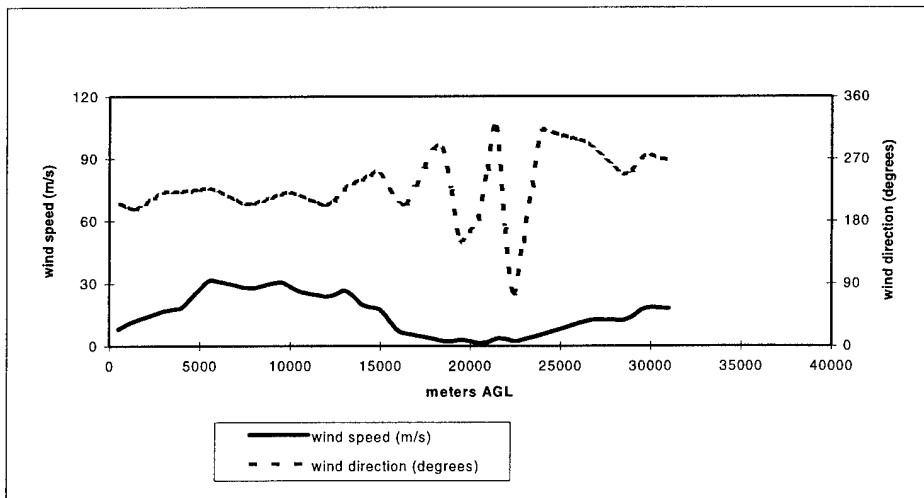


Figure 83. Trapani 911012-1100

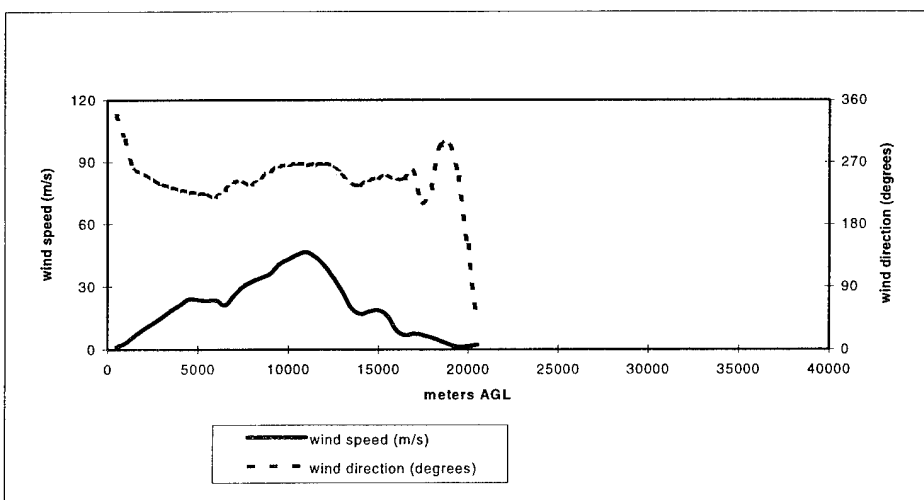
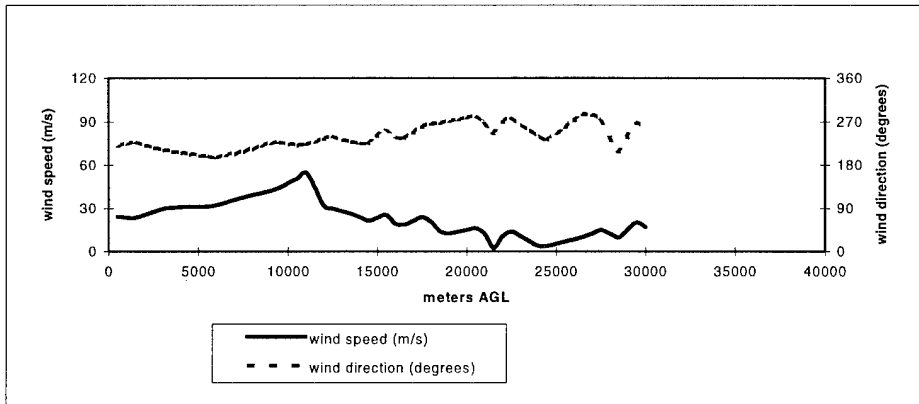
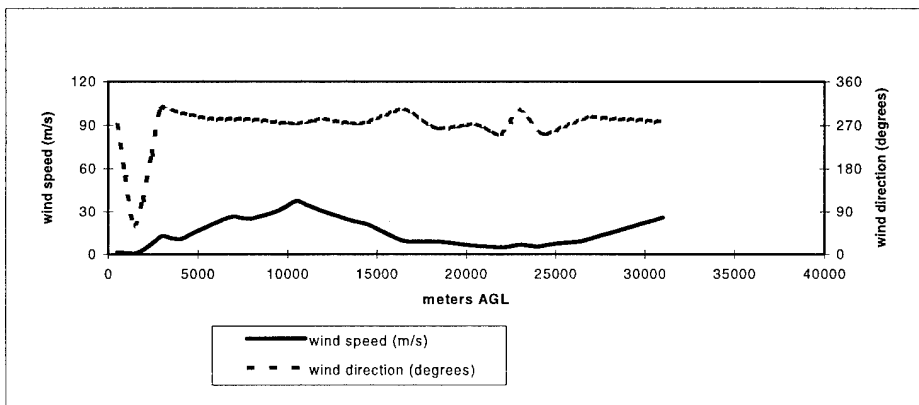


Figure 84. Trapani 911013-0500

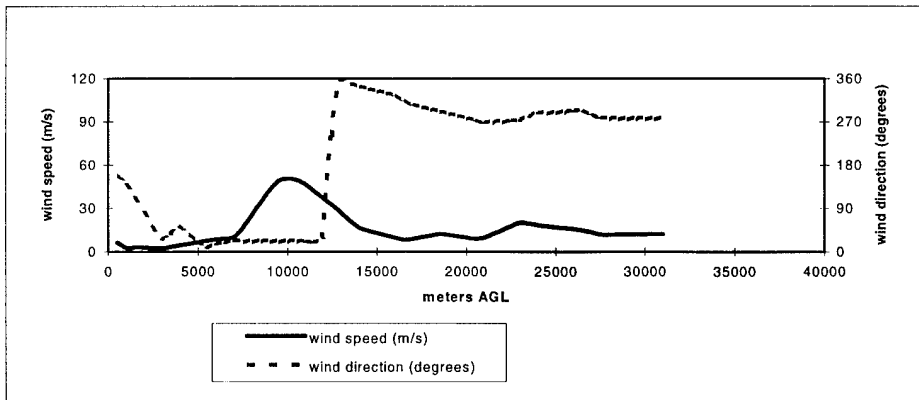




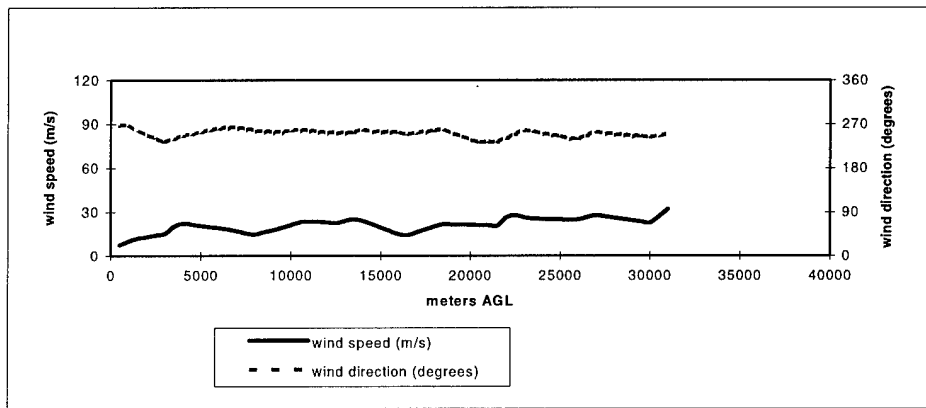
**Figure 85. Trapani 911019-1700**



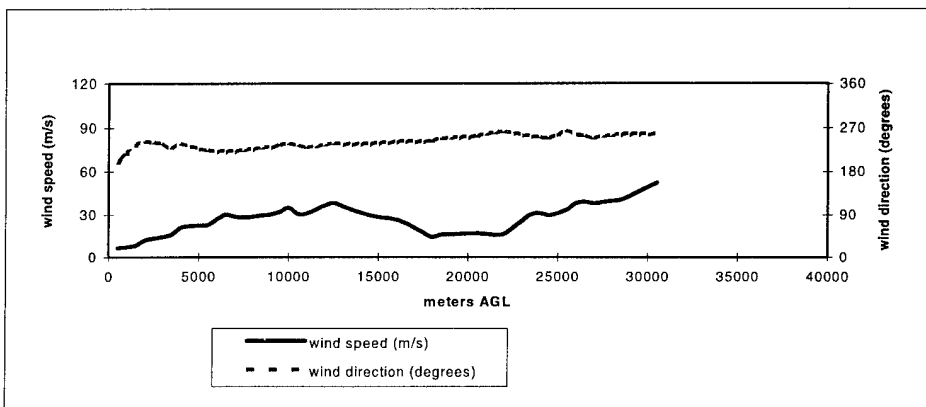
**Figure 86. Trapani 911024-1100**



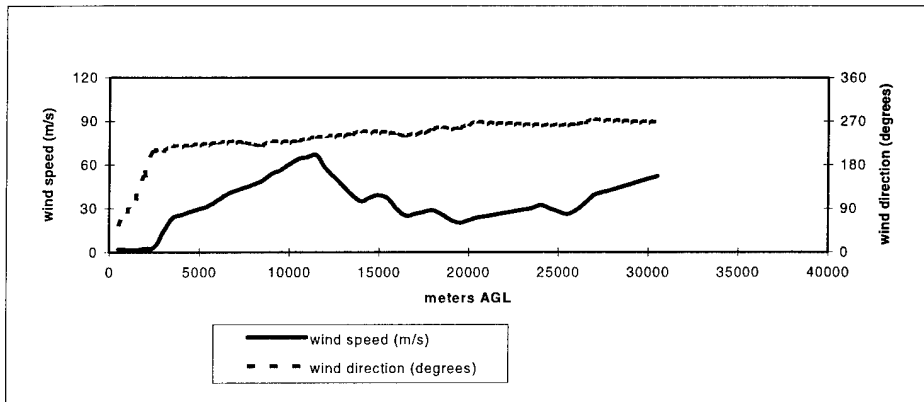
**Figure 87. Trapani 911101-0500**



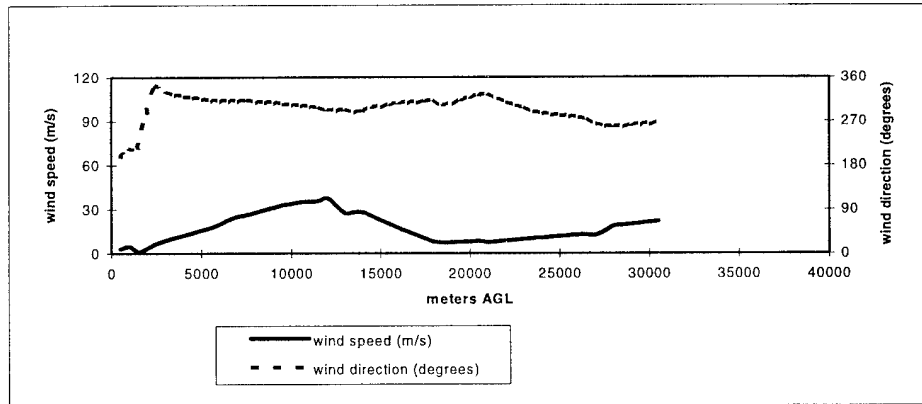
**Figure 88. Trapani 911105-1100**



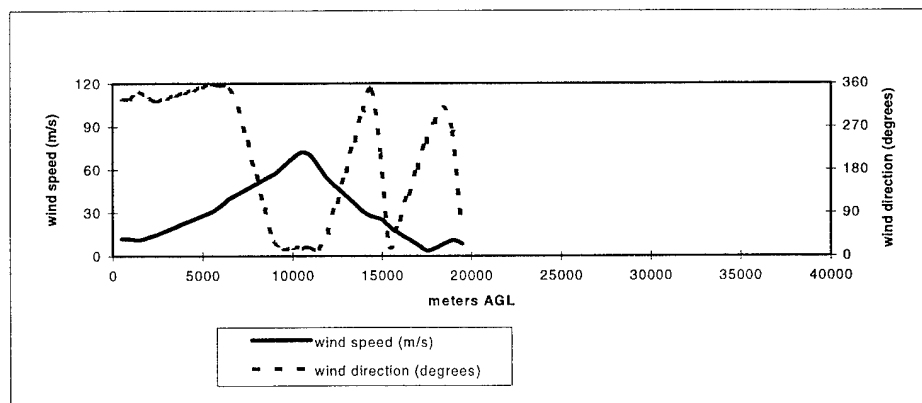
**Figure 89. Trapani 911120-1100**



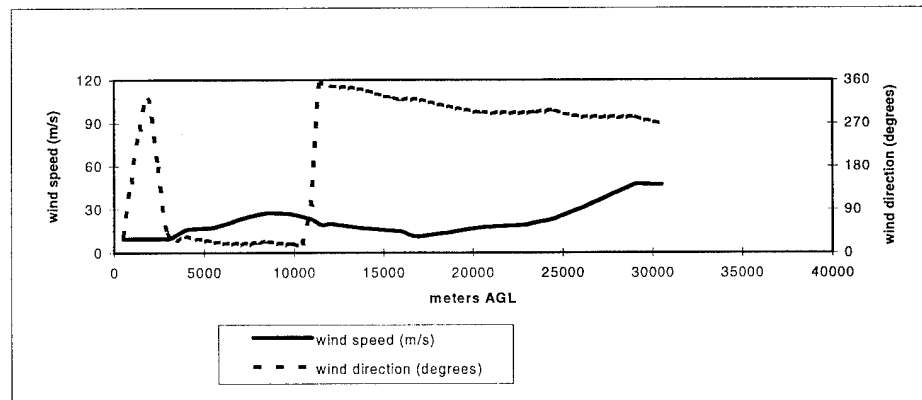
**Figure 90. Trapani 911123-0500**



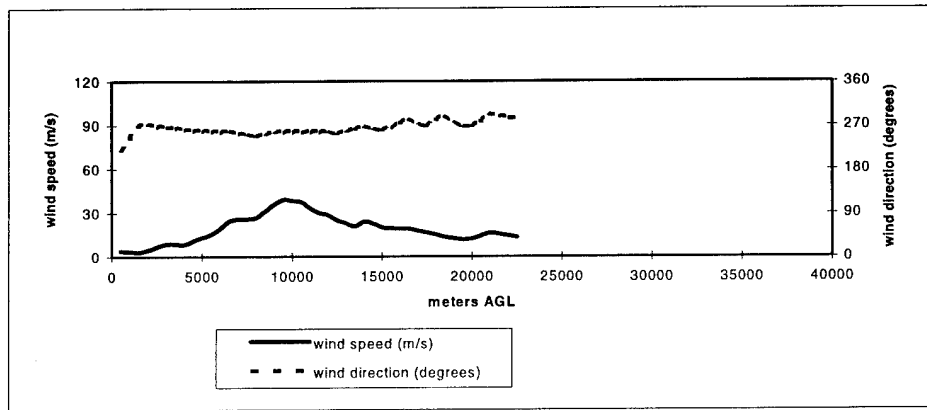
**Figure 91. Trapani 91129-1100**



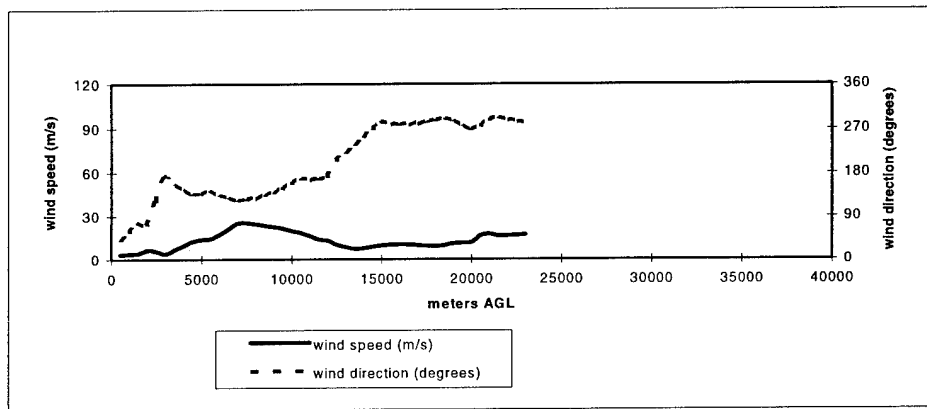
**Figure 92. Trapani 911222-0500**



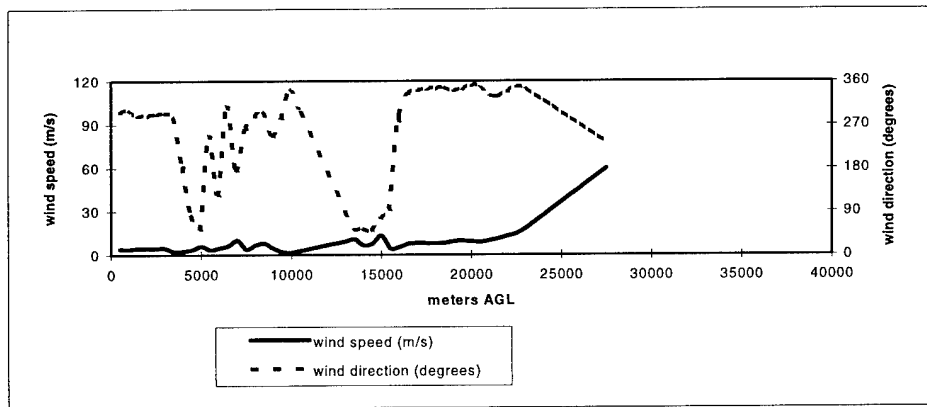
**Figure 93. Trapani 911230-0500**



**Figure 94. Trapani 920104-1700**



**Figure 95. Trapani 920116-1100**



**Figure 96. Trapani 920131-1100**

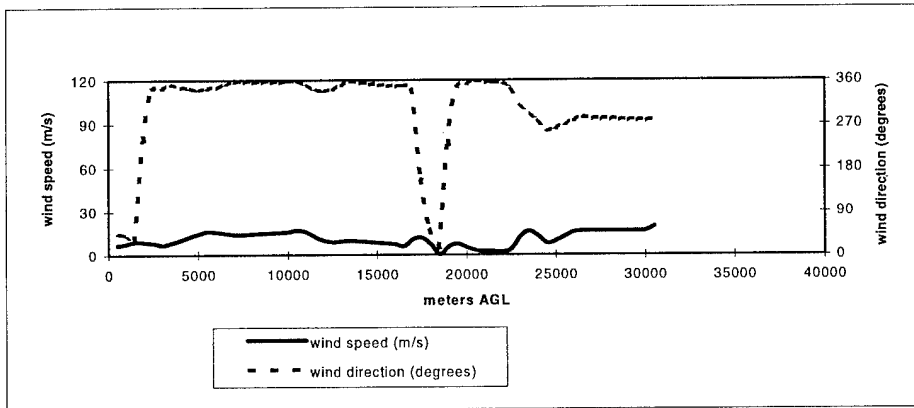


Figure 97. Trapani 920201-1100

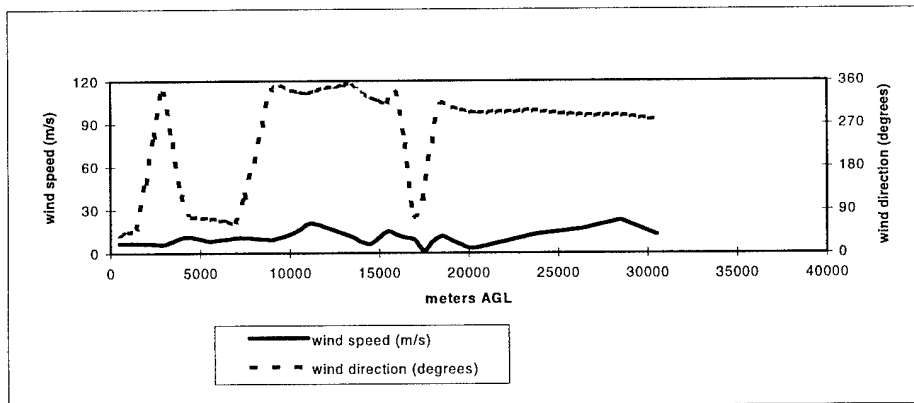


Figure 98. Trapani 920201-1700

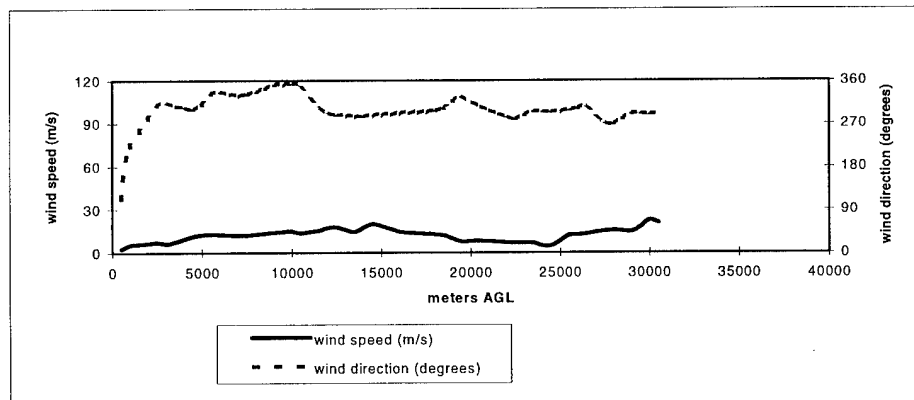
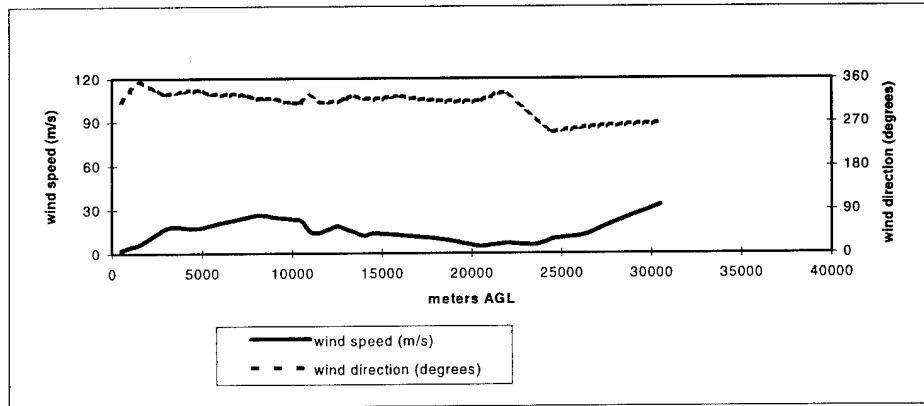
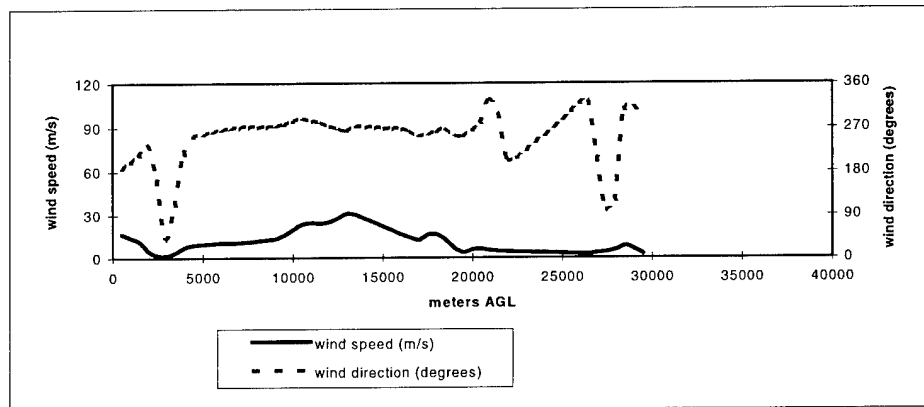


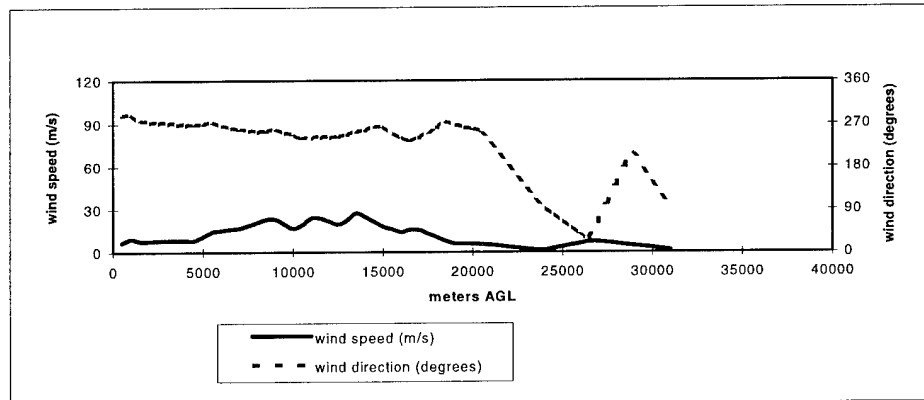
Figure 99. Trapani 920210-1700



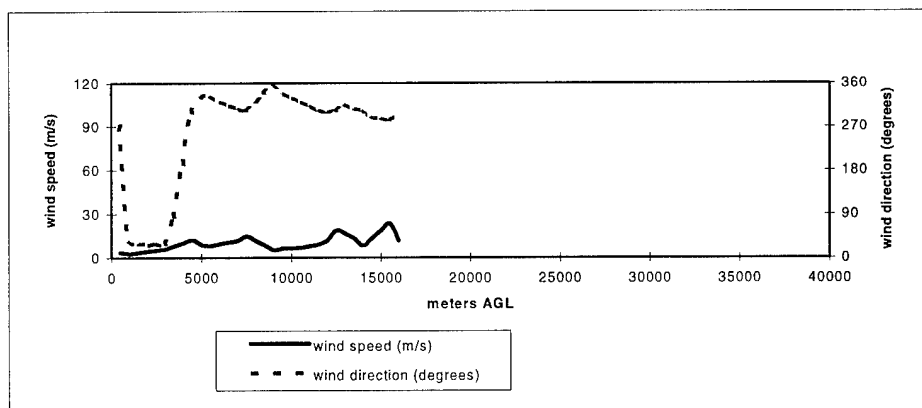
**Figure 100. Trapani 920319-1100**



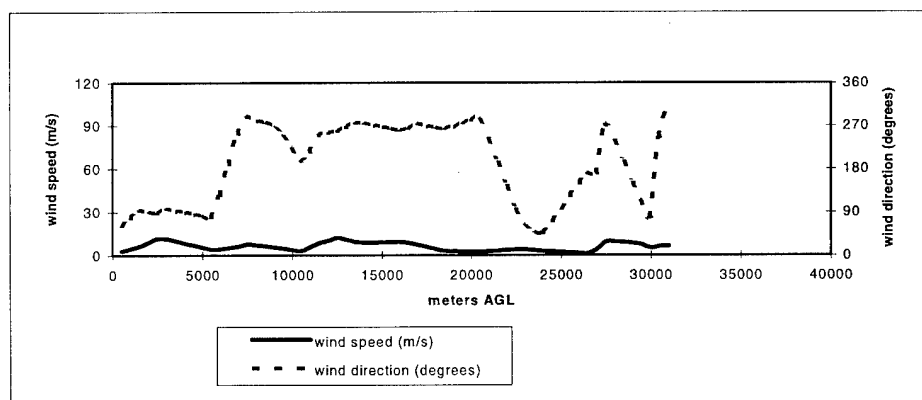
**Figure 101. Trapani 920403-2300**



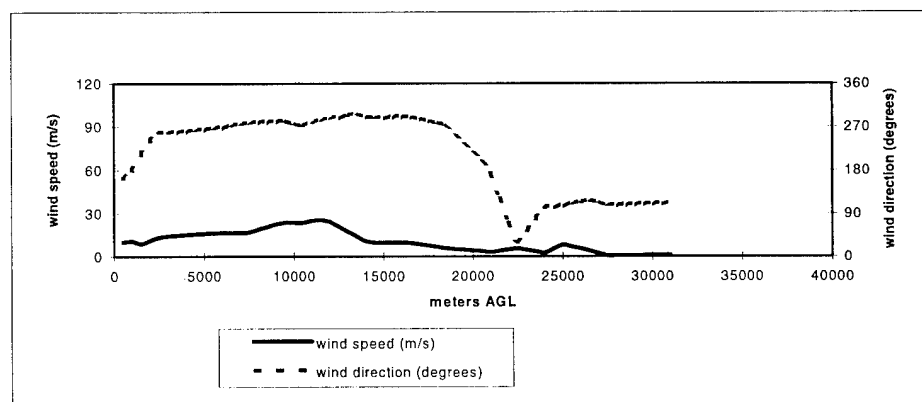
**Figure 102. Trapani 920406-2300**



**Figure 103. Trapani 920420-2300**



**Figure 104. Trapani 920504-0500**



**Figure 105. Trapani 920520-2300**

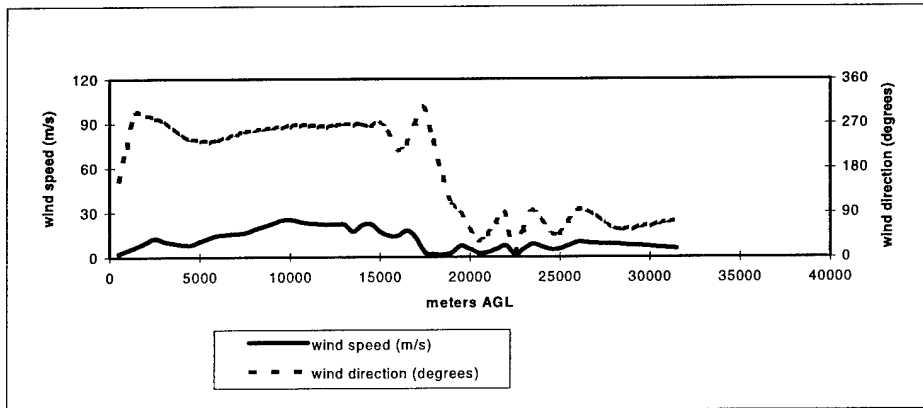


Figure 106. Trapani 920623-2300

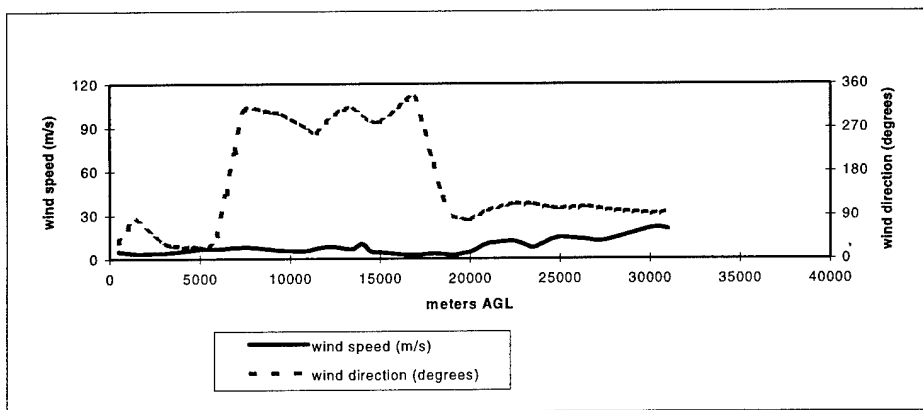


Figure 107. Trapani 920716-1100

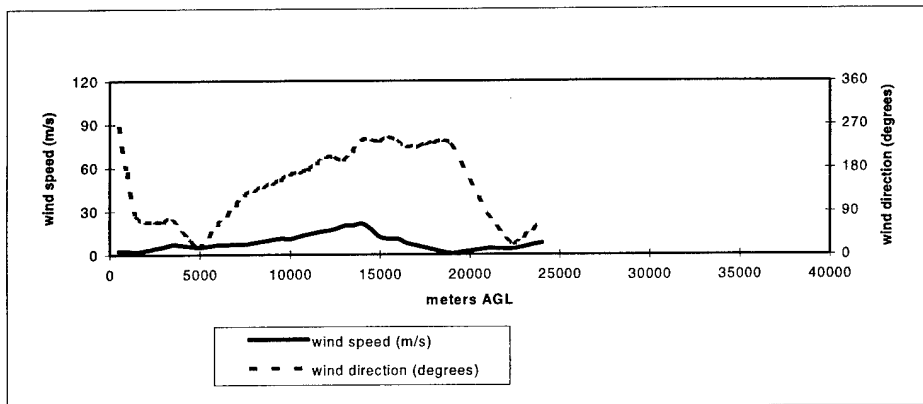


Figure 108. Trapani 920729-1700



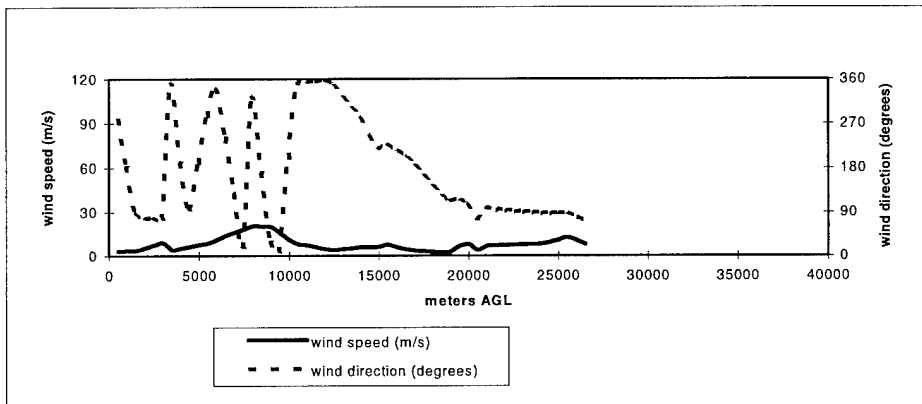


Figure 109. Trapani 920807-1700

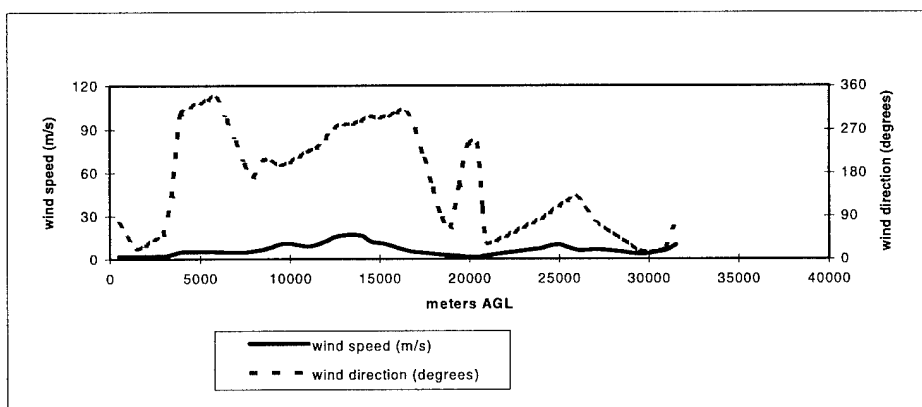


Figure 110. Trapani 920825-2300

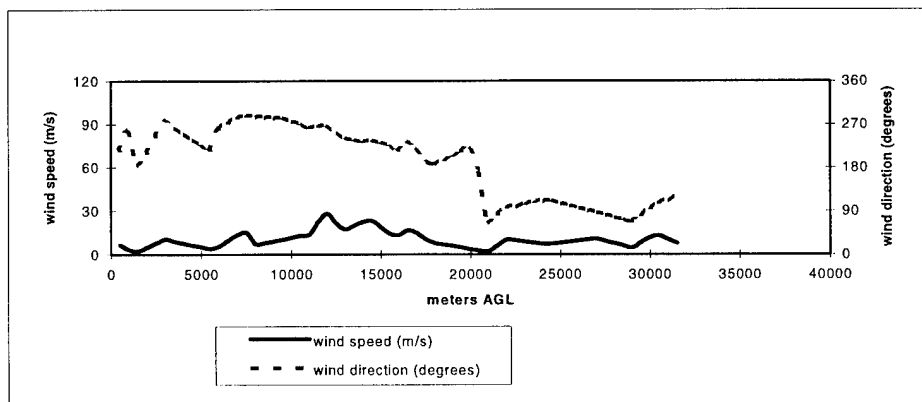
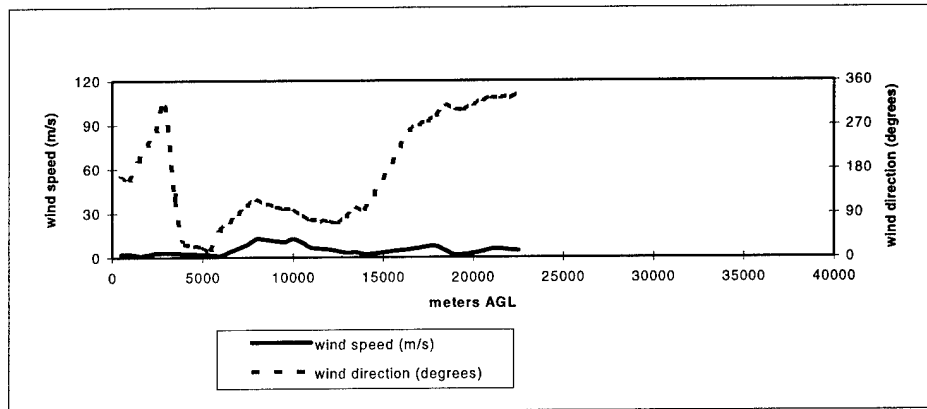
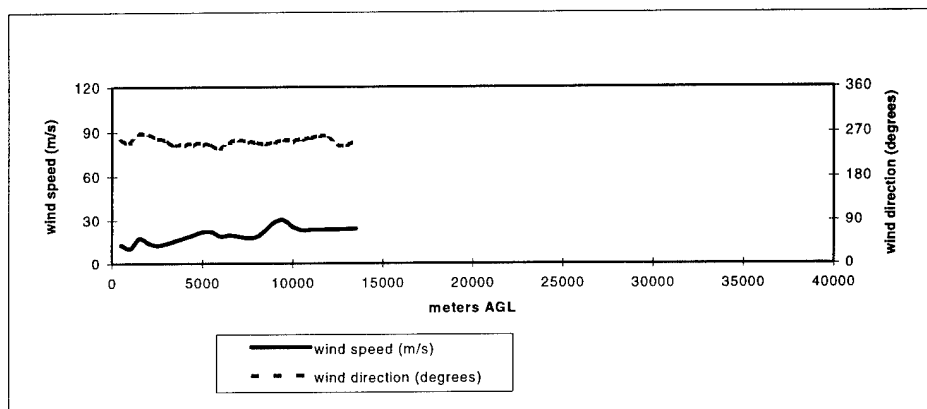


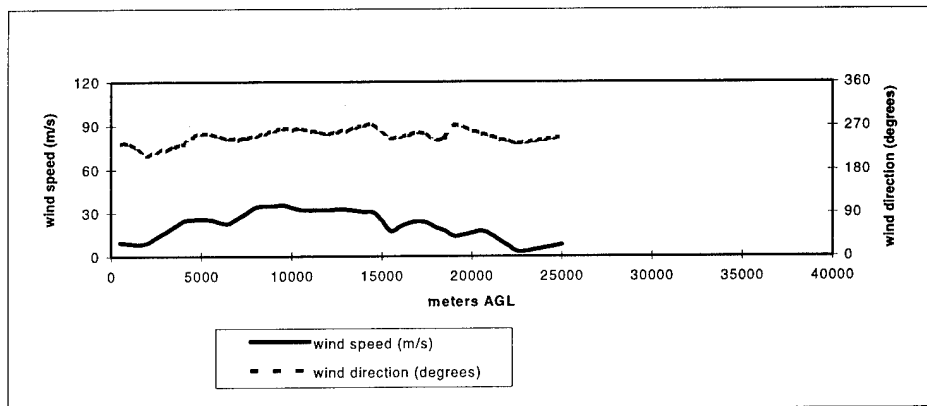
Figure 111. Trapani 920829-1700



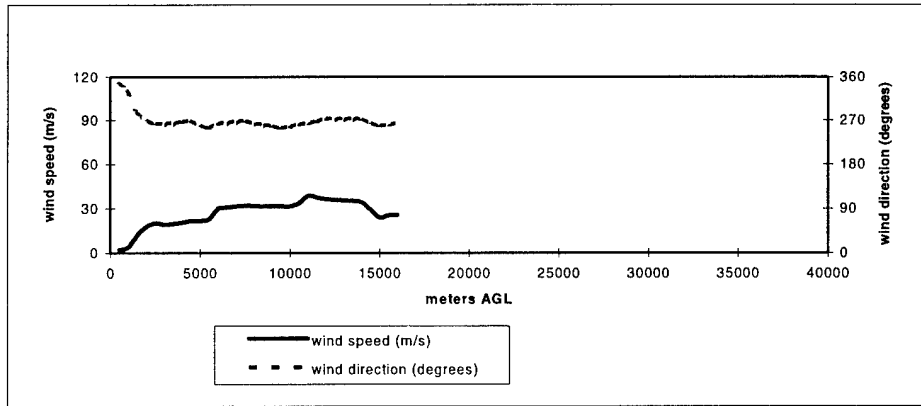
**Figure 112. Trapani 920916-2300**



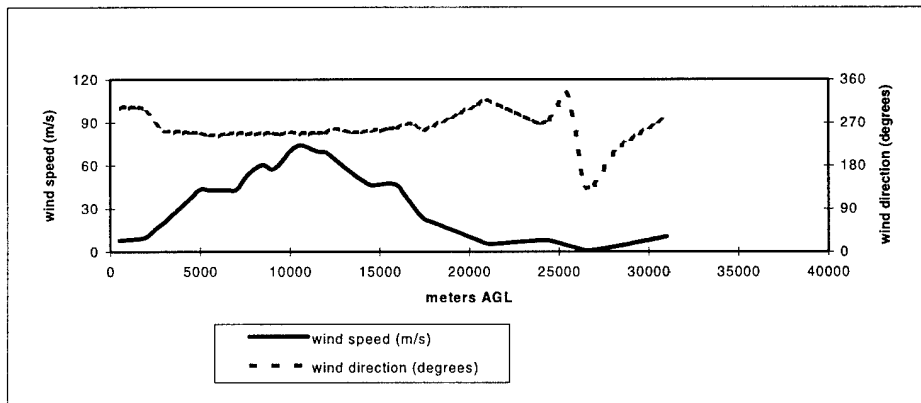
**Figure 113. Trapani 921014-2300**



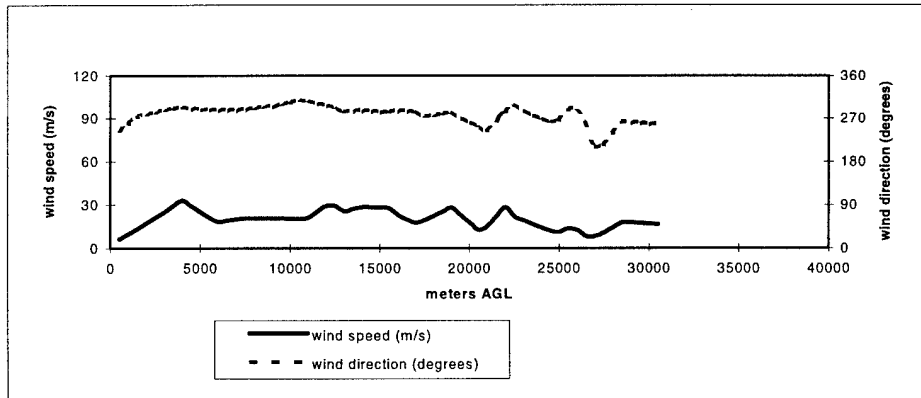
**Figure 114. Trapani 921017-1600**



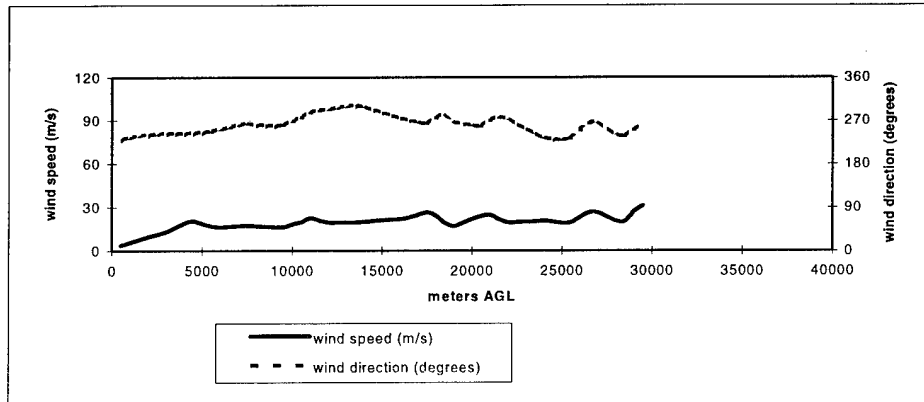
**Figure 115. Trapani 921018-2300**



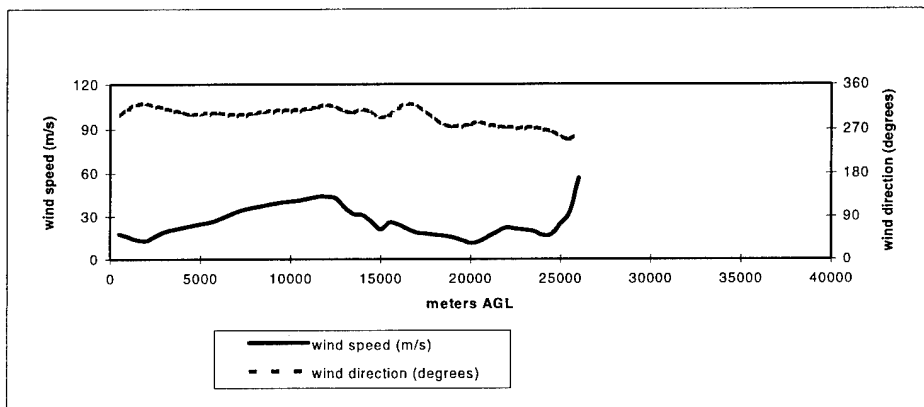
**Figure 116. Trapani 921023-0500**



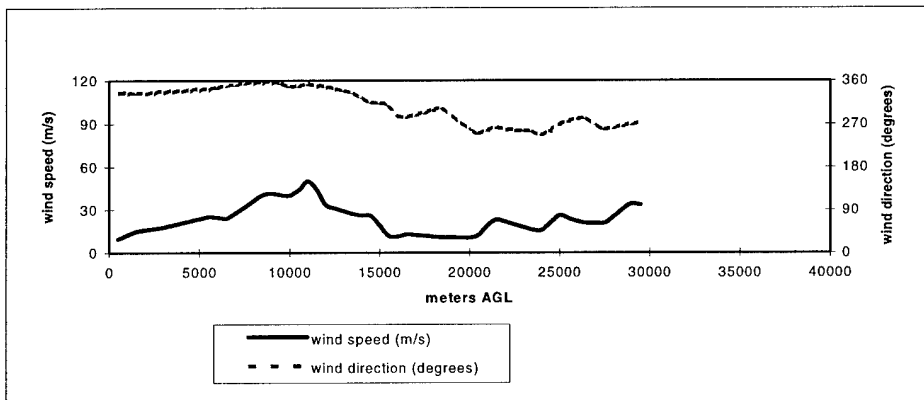
**Figure 117. Trapani 921026-2300**



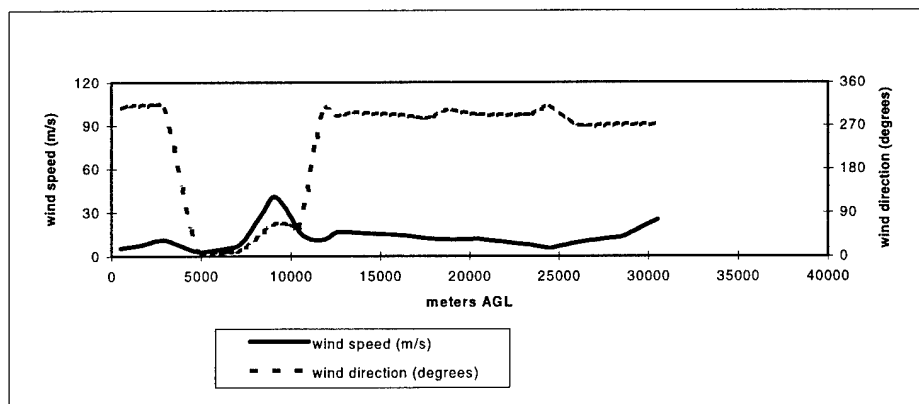
**Figure 118. Trapani 921029-2300**



**Figure 119. Trapani 921114-0500**



**Figure 120. Trapani 921119-2300**



**Figure 121. Trapani 921212-1100**

### 6.3 Ankara, Turkey

**Table 5. Table of Spread Distances (m), Ankara, Turkey**

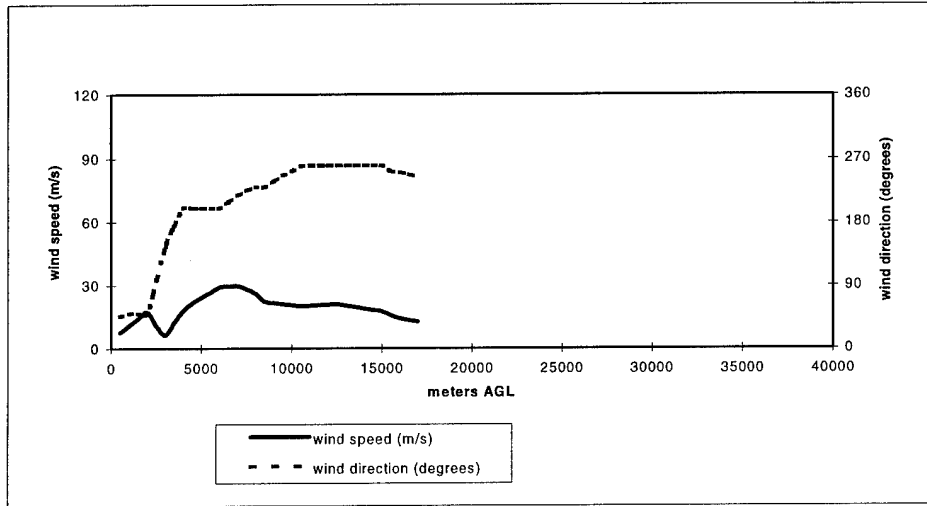
Order Statistic	Intercept Altitude					
	5 km			10 km		
	Spread Distance	Date/Time	Figure No.	Spread Distance	Date/Time	Figure No.
Minimum	155.	920513-0000	151	1151.	920802-1200	164
5th percentile	3055.	920727-0000	163	9333.	911021-0000	142
10th percentile	4273.	910524-0000	130	14614.	920623-0000	158
25th percentile	7164.	911105-1200	143	22660.	920820-1200	167
Median	11493.	921112-1200	175	34887.	910203-0000	122
75th percentile	17257.	921213-0000	176	48801.	910801-0000	137
90th percentile	23343.	920527-1200	155	64360.	910528-1200	133
95th percentile	27554.	921015-1200	172	73623.	910514-0000	128
Maximum	42249.	921024-1200	174	101662.	921023-1200	173
Number of Valid Profiles	1239			1237		

Order Statistic	Intercept Altitude					
	20 km			30 km		
	Spread Distance	Date/Time	Figure No.	Spread Distance	Date/Time	Figure No.
Minimum	8179.	921217-0000	178	5959.	920811-1200	165
5th percentile	23364.	921215-0000	177	21567.	920518-1200	154
10th percentile	31905.	920129-1200	145	29702.	920515-1200	153
25th percentile	49912.	911014-0000	141	52050.	920820-1200	167
Median	71393.	910425-1200	127	77237.	920406-1200	147
75th percentile	94350.	920725-0000	162	109327.	910327-0000	126
90th percentile	119926.	910528-1200	133	133986.	910526-1200	132
95th percentile	131157.	920409-0000	148	151809.	921008-0000	171
Maximum	184992.	921023-1200	173	198880.	921023-1200	173
Number of Valid Profiles	1075			330		

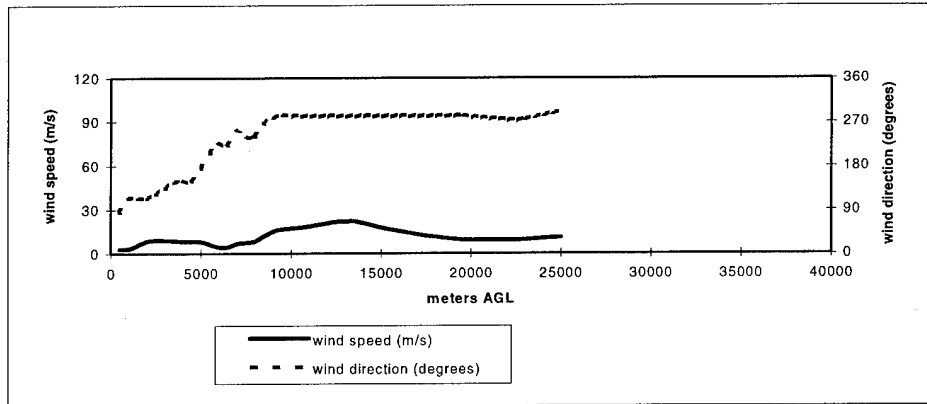
**Table 6. Table of Travel Distances (m), Ankara, Turkey**

Order Statistic	Intercept Altitude					
	5 km			10 km		
	Travel Distance	Date/Time	Figure No.	Travel Distance	Date/Time	Figure No.
Minimum	14.	920513-0000	151	524.	920514-0000	152
5th percentile	1028.	920511-1200	150	2940.	911011-1200	140
10th percentile	1437.	910925-1200	138	4431.	920820-0000	166
25th percentile	2408.	920618-1200	157	7006.	910224-1200	125
Median	3860.	920613-0000	156	10758.	910208-0000	124
75th percentile	5742.	920927-0000	170	15144.	910801-0000	137
90th percentile	7810.	920907-1200	168	19901.	910526-1200	132
95th percentile	9217.	921015-1200	172	22798.	910514-1200	129
Maximum	14169.	921024-1200	174	31728.	921023-1200	173
Number of Valid Profiles	1239			1237		

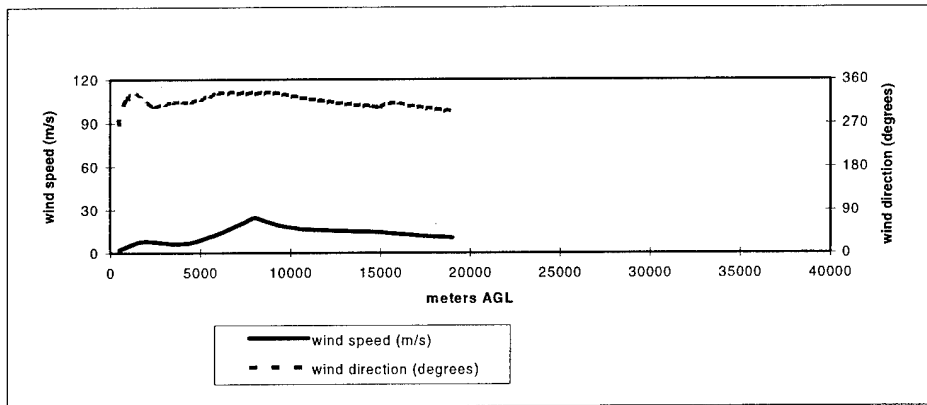
Order Statistic	Intercept Altitude					
	20 km			30 km		
	Travel Distance	Date/Time	Figure No.	Travel Distance	Date/Time	Figure No.
Minimum	1143.	920322-0000	146	1148.	910630-1200	134
5th percentile	6606.	911009-0000	139	6731.	920624-0000	159
10th percentile	8578.	910206-1200	123	8463.	920722-1200	161
25th percentile	13608.	920105-0000	144	14537.	920912-1200	169
Median	19707.	910706-1200	135	21122.	910525-0000	131
75th percentile	26089.	910730-0000	136	28623.	920709-1200	160
90th percentile	33163.	920410-1200	149	35307.	910526-1200	132
95th percentile	36574.	920409-0000	148	39015.	921008-0000	171
Maximum	51754.	921023-1200	173	53789.	921023-1200	173
Number of Valid Profiles	1075			330		



**Figure 122. Ankara 910203-0000**

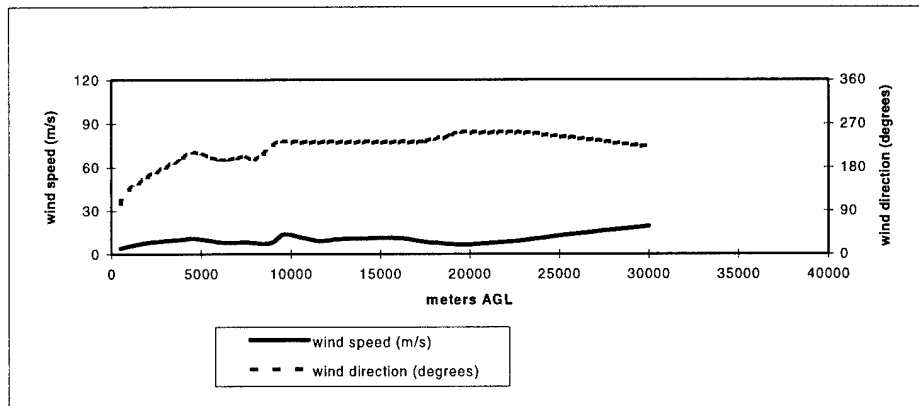


**Figure 123. Ankara 910206-1200**

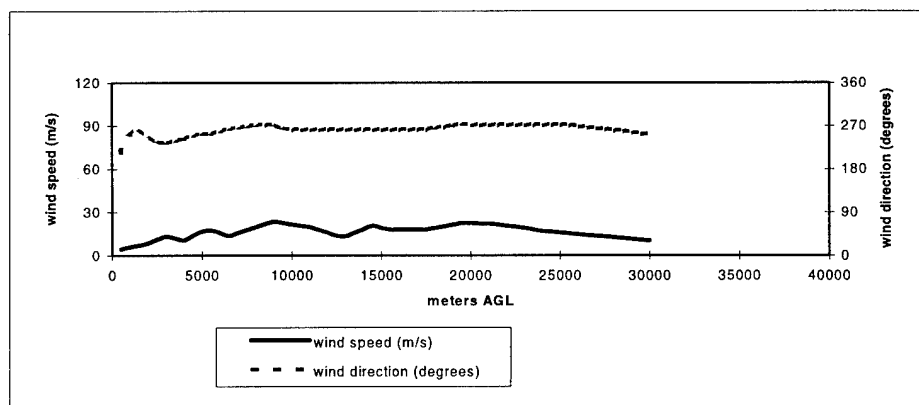


**Figure 124. Ankara 910208-0000**

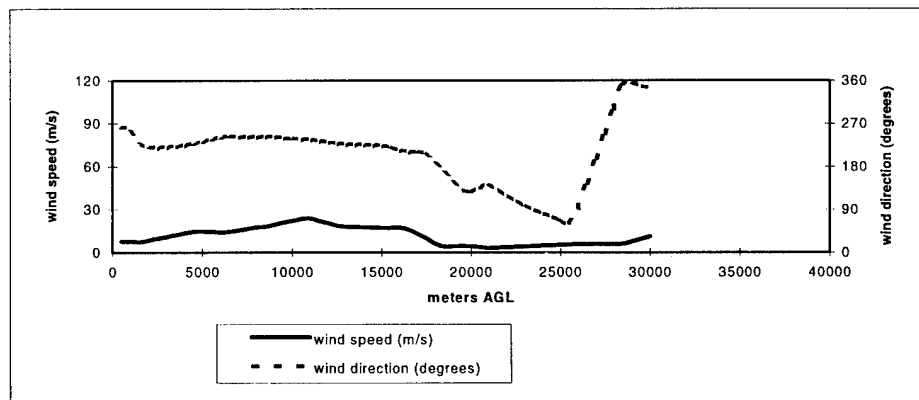




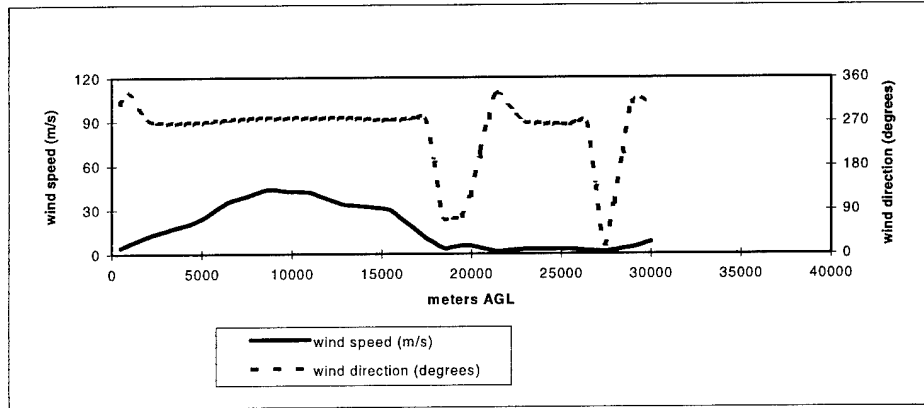
**Figure 125. Ankara 910224-1200**



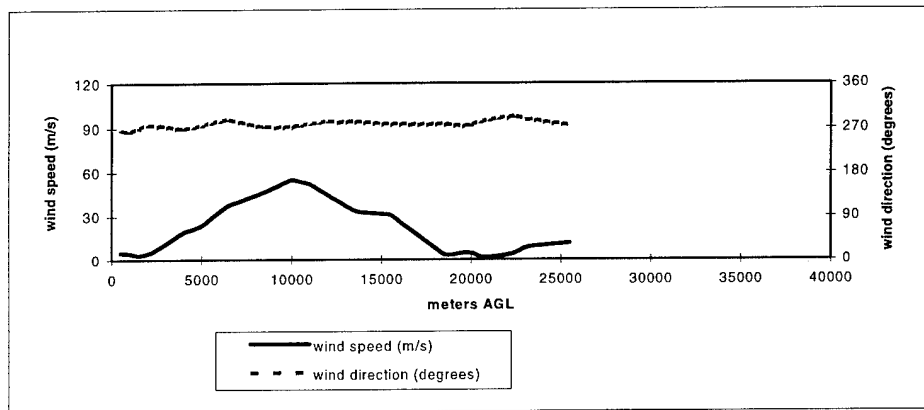
**Figure 126. Ankara 910327-0000**



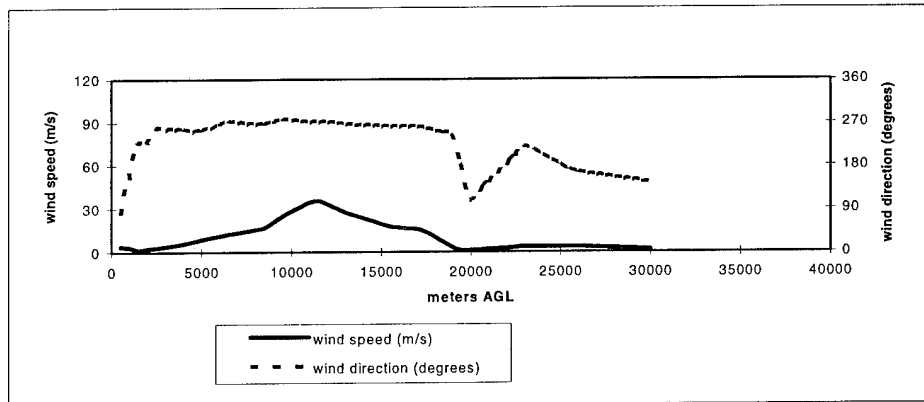
**Figure 127. Ankara 910425-1200**



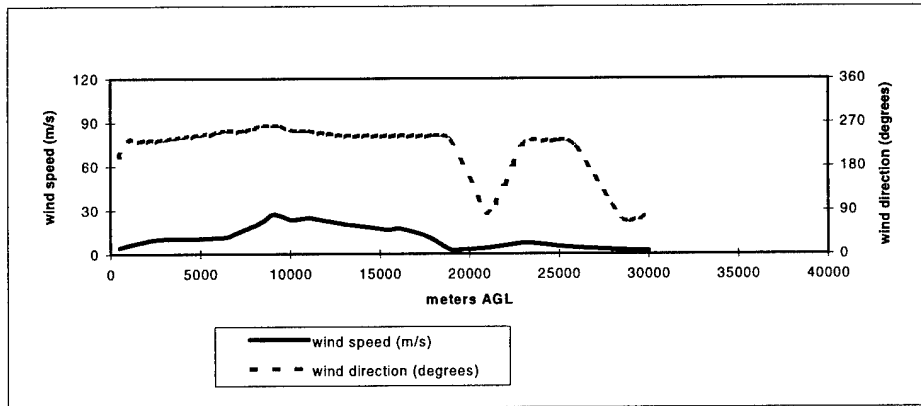
**Figure 128. Ankara 910514-0000**



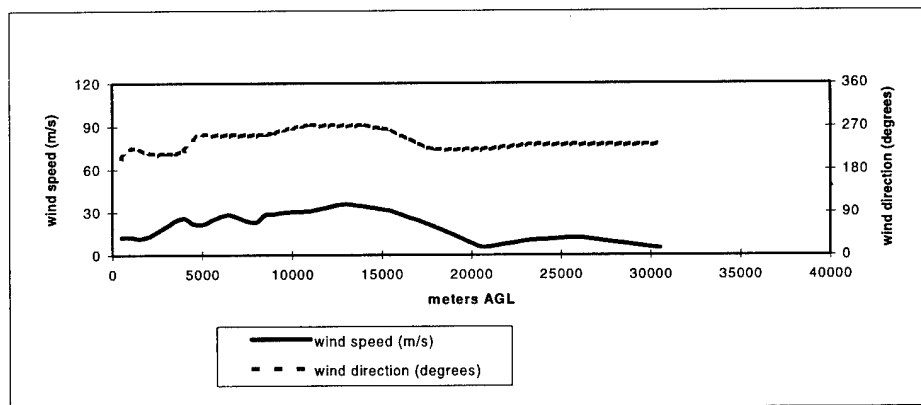
**Figure 129. Ankara 915014-1200**



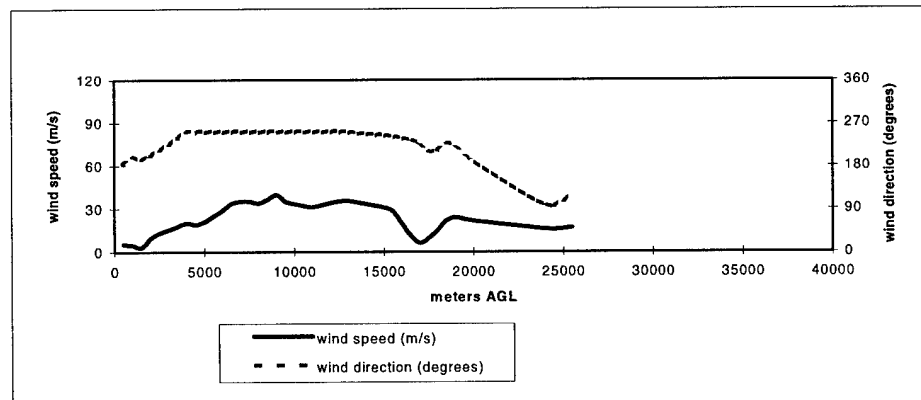
**Figure 130. Ankara 910524-0000**



**Figure 131. Ankara 910525-0000**



**Figure 132. Ankara 910526-1200**



**Figure 133. Ankara 910528-1200**

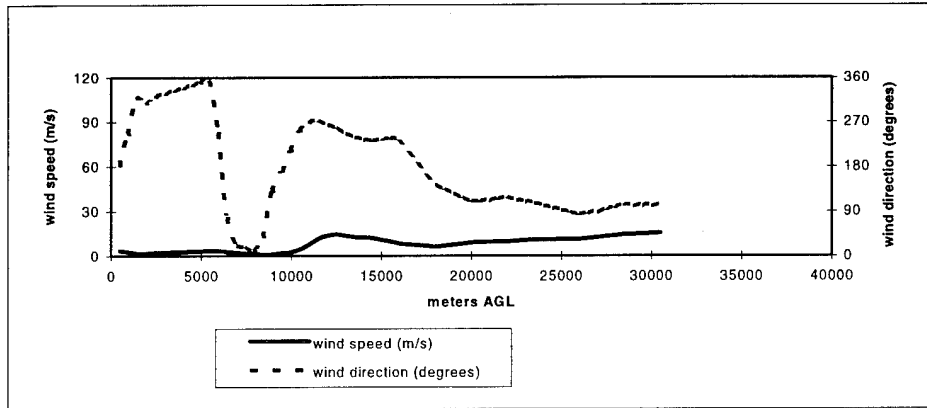


Figure 134. Ankara 910630-1200

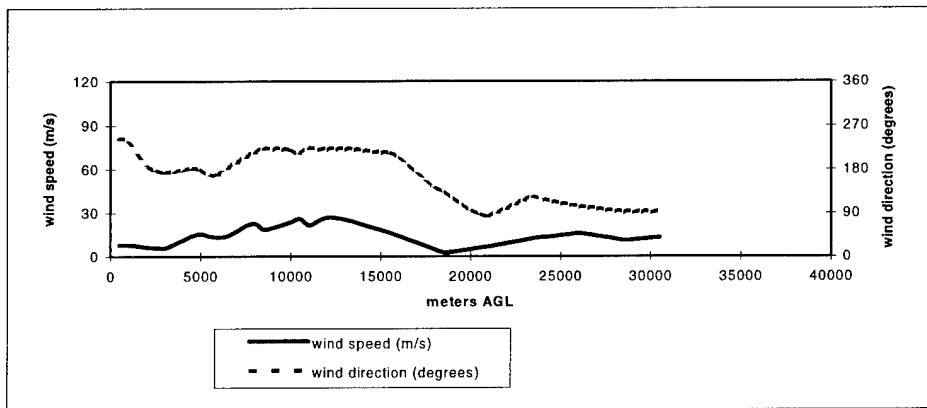


Figure 135. Ankara 910706-1200

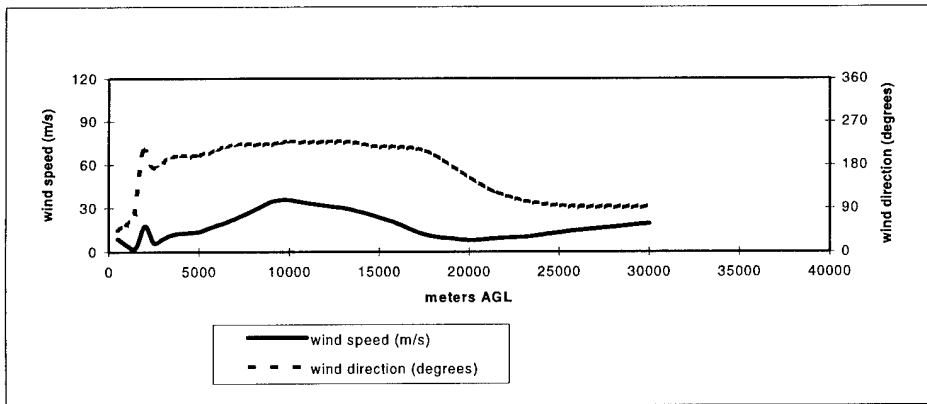
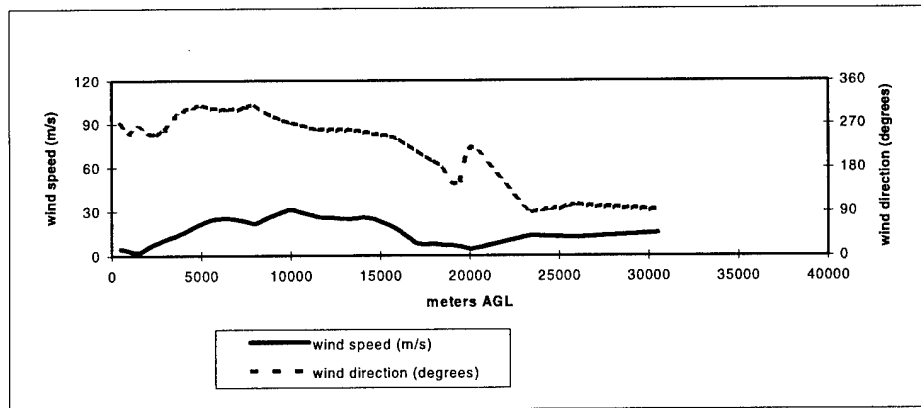
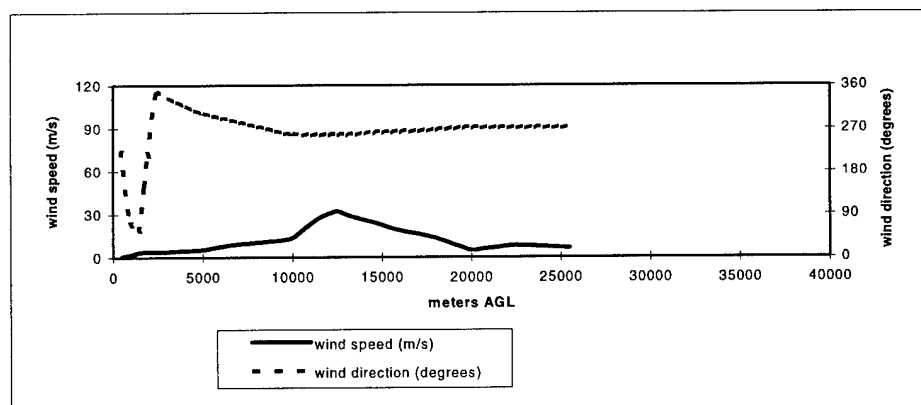


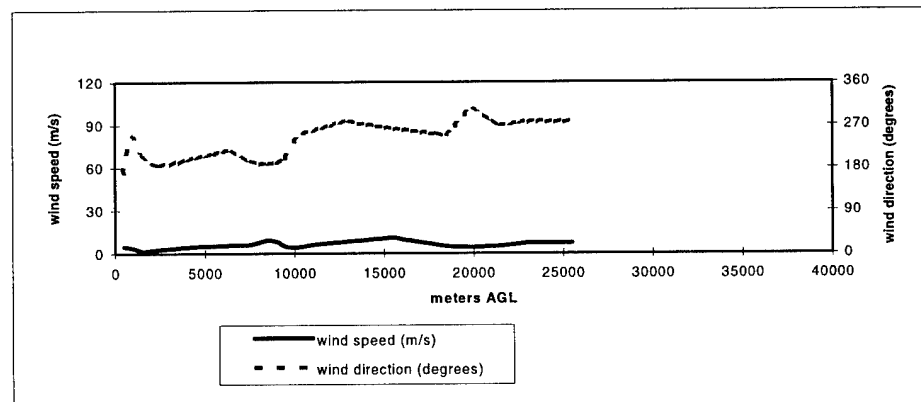
Figure 136. Ankara 910730-0000



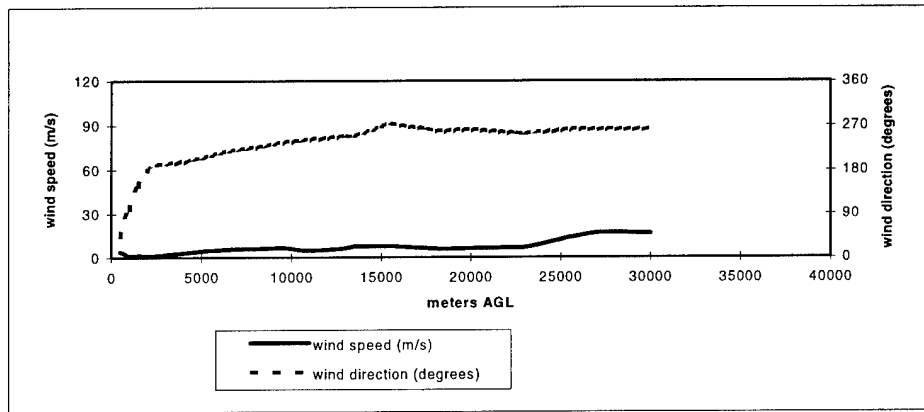
**Figure 137. Ankara 910801-0000**



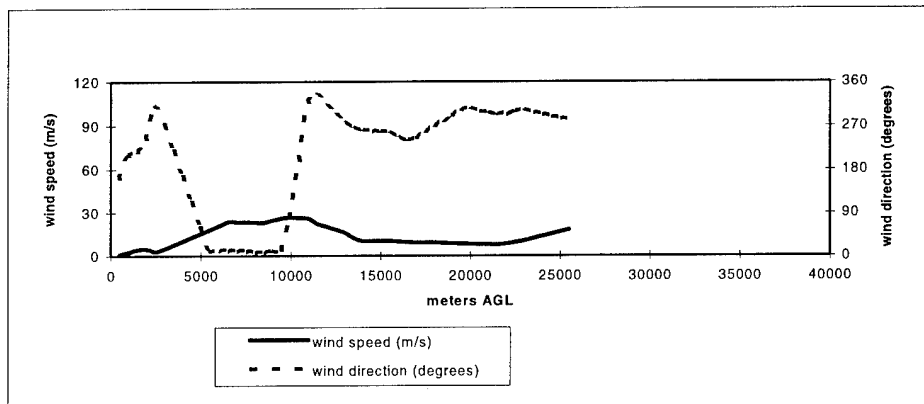
**Figure 138. Ankara 910925-1200**



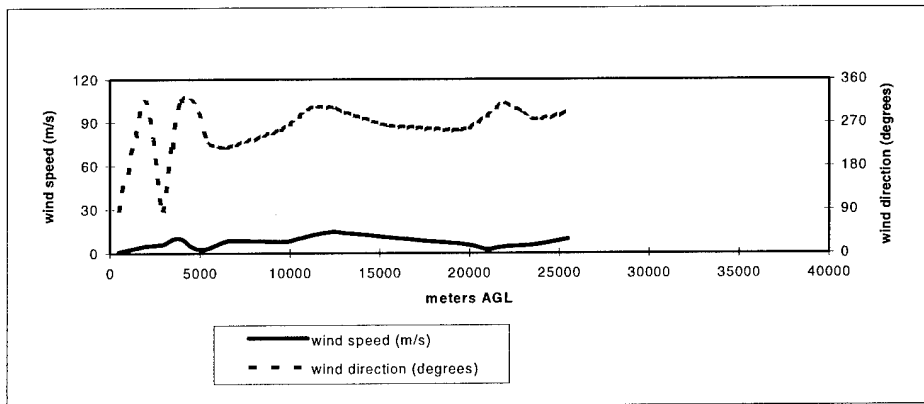
**Figure 139. Ankara 911009-0000**



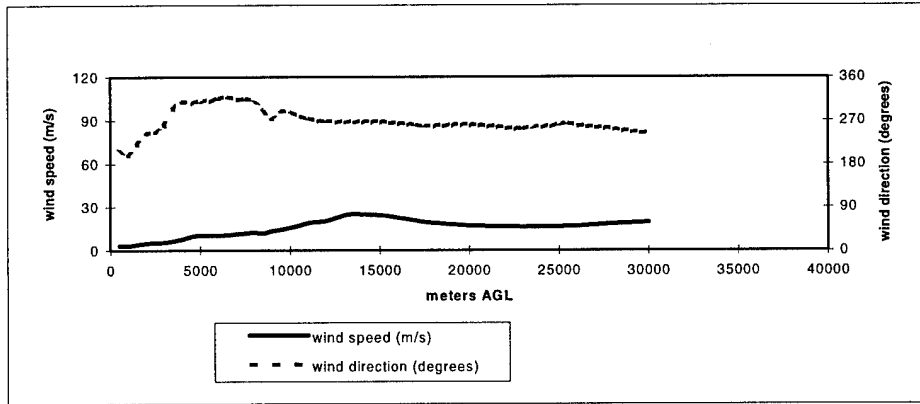
**Figure 140. Ankara 911011-1200**



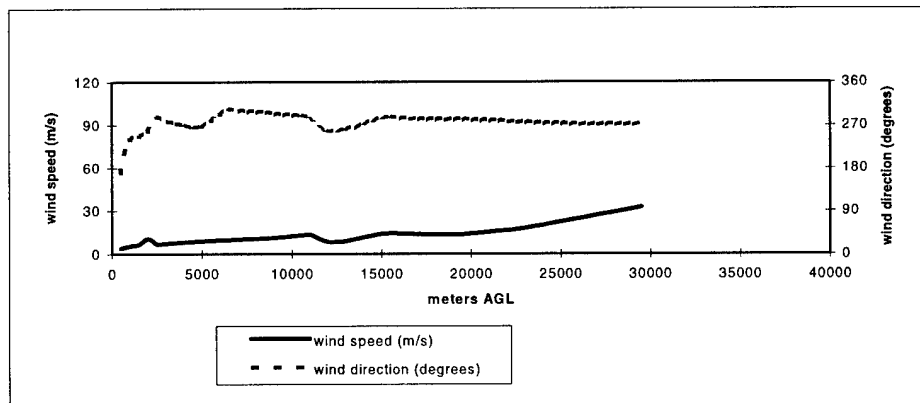
**Figure 141. Ankara 911014-0000**



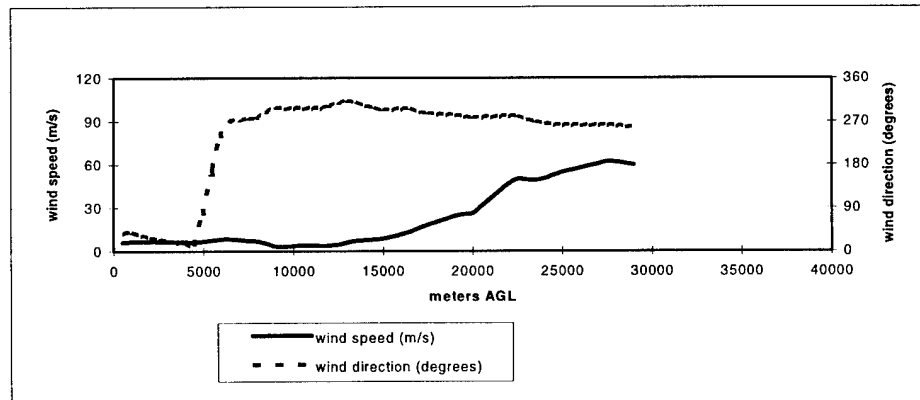
**Figure 142. Ankara 911021-0000**



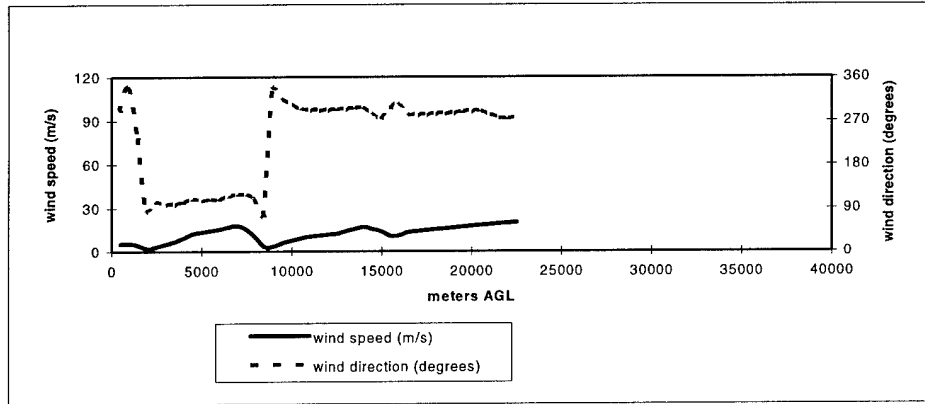
**Figure 143. Ankara 911105-1200**



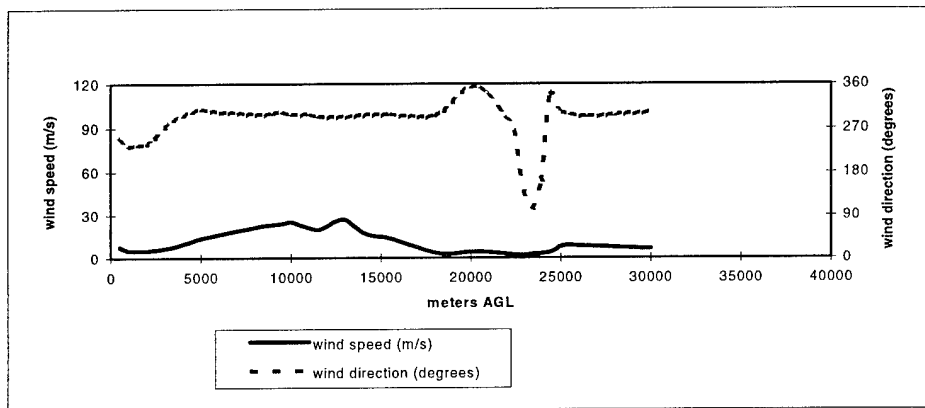
**Figure 144. Ankara 920105-0000**



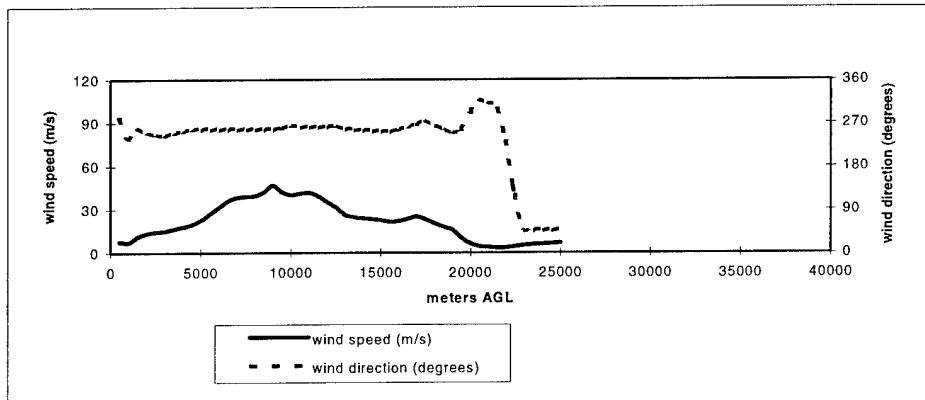
**Figure 145. Ankara 920129-1200**



**Figure 146. Ankara 920322-0000**



**Figure 147. Ankara 920406-1200**



**Figure 148. Ankara 920409-0000**



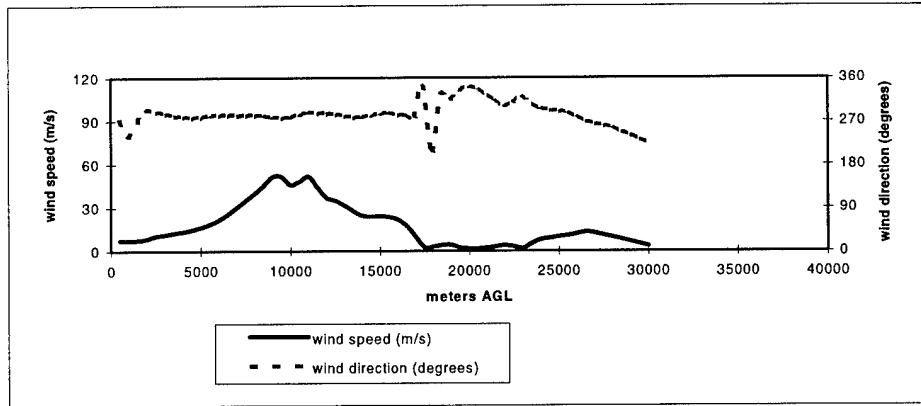


Figure 149. Ankara 920410-1200

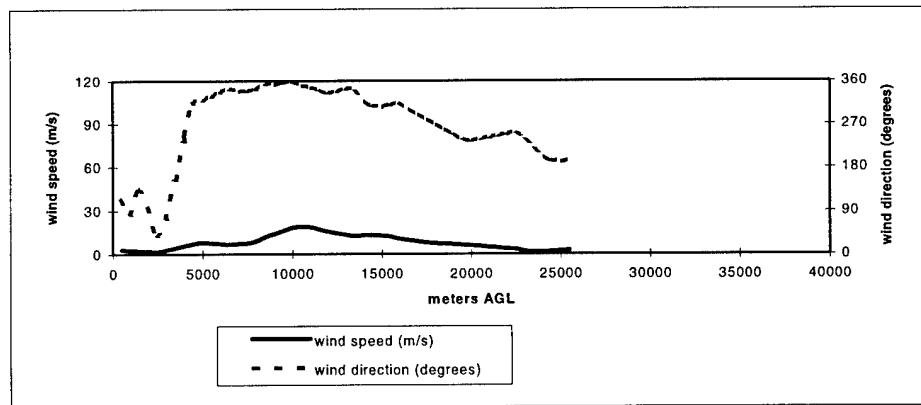


Figure 150. Ankara 920511-1200

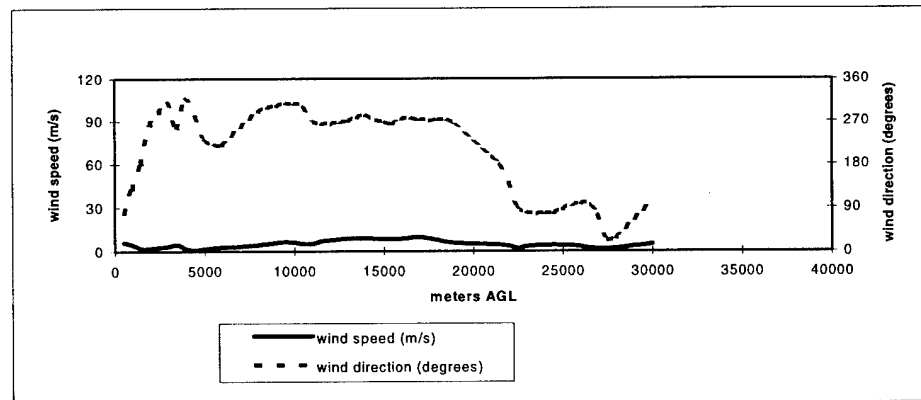
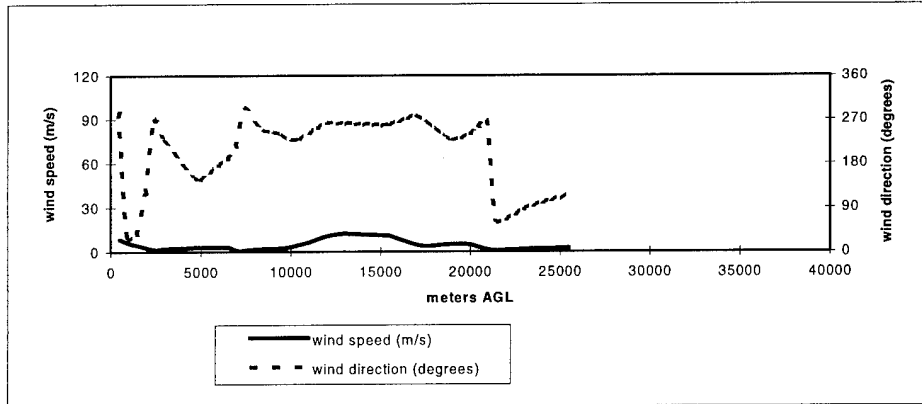
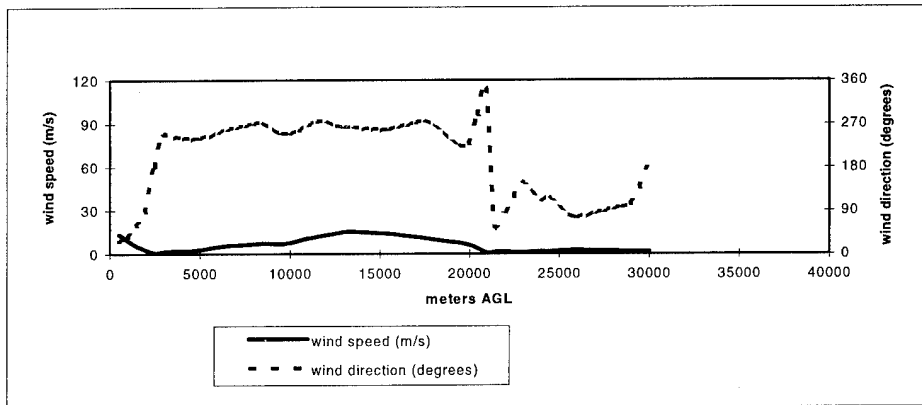


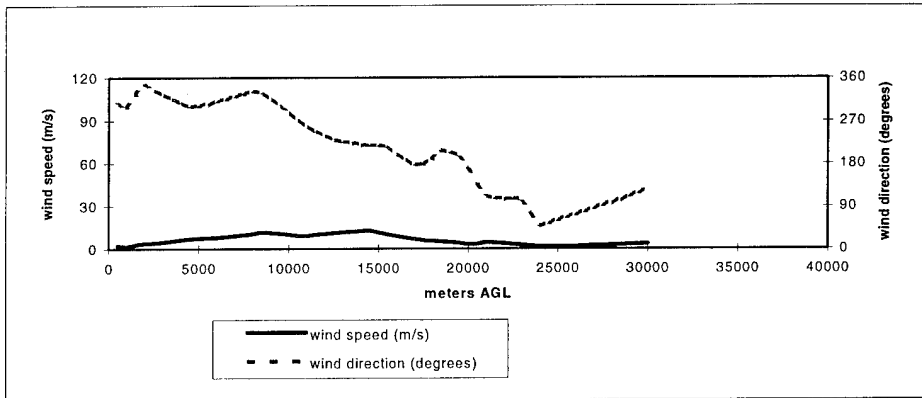
Figure 151. Ankara 920513-0000



**Figure 152. Ankara 920514-0000**



**Figure 153. Ankara 920515-1200**



**Figure 154. Ankara 920518-1200**

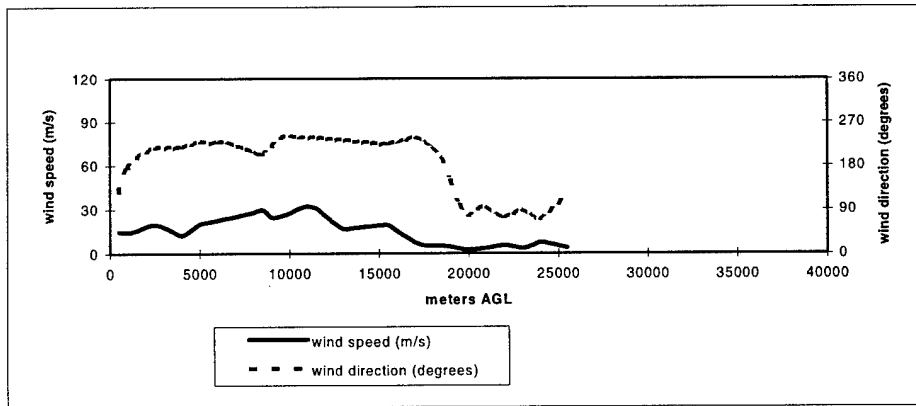


Figure 155. Ankara 920527-1200

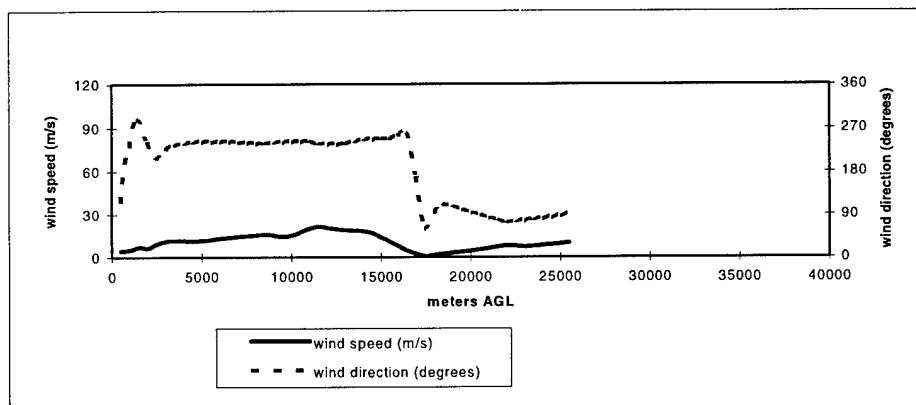


Figure 156. Ankara 920613-0000

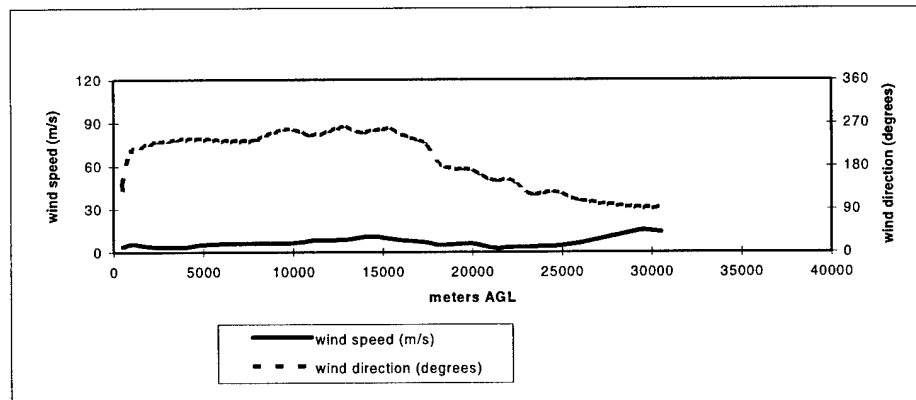


Figure 157. Ankara 920618-1200

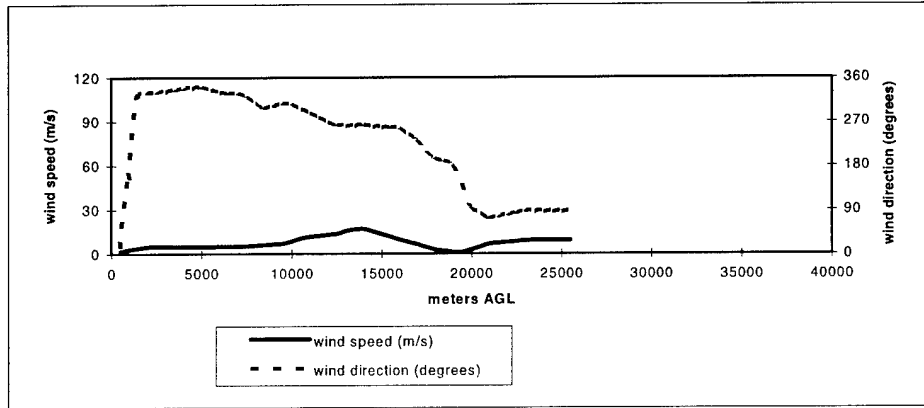


Figure 158. Ankara 920623-0000

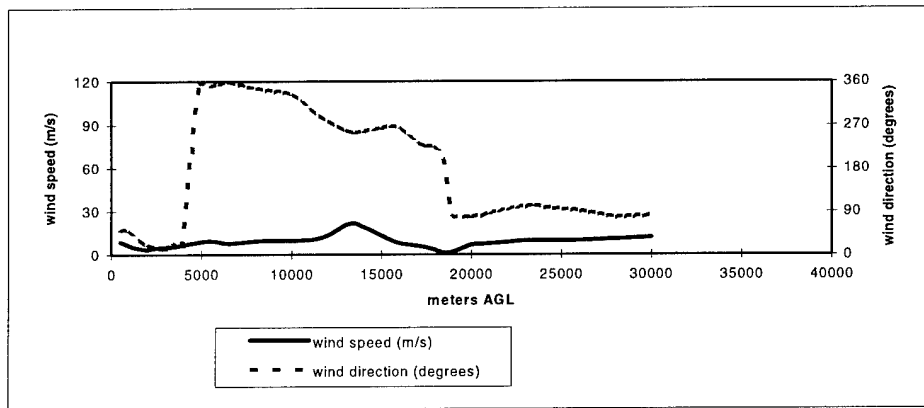


Figure 159. Ankara 920624-0000

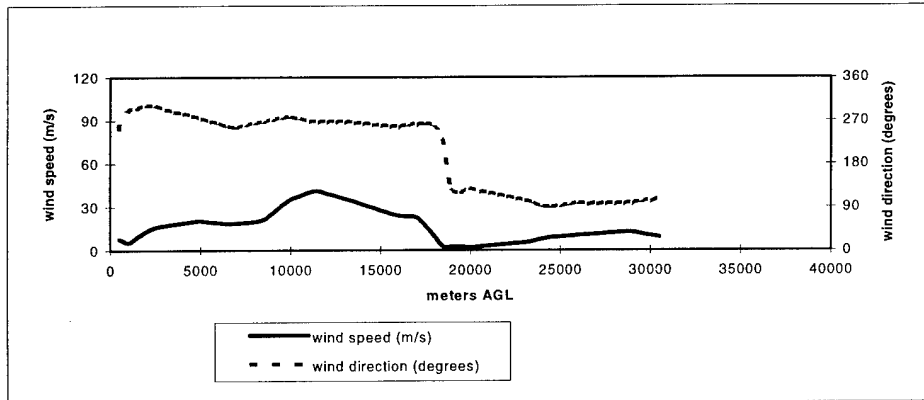


Figure 160. Ankara 920709-1200

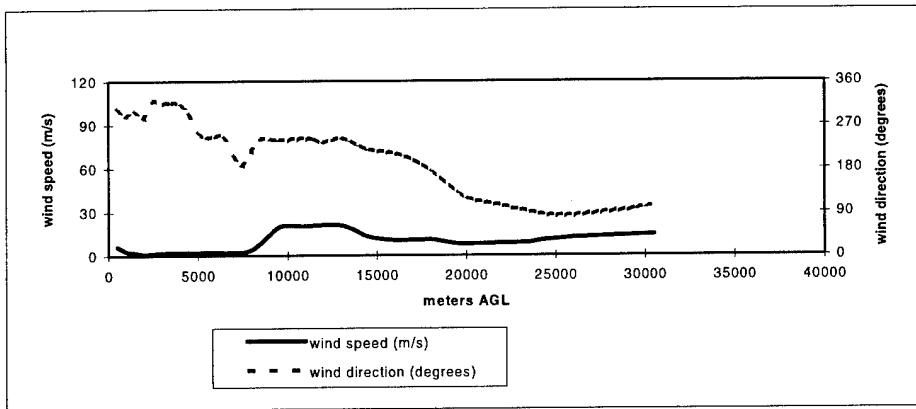


Figure 161. Ankara 920722-1200

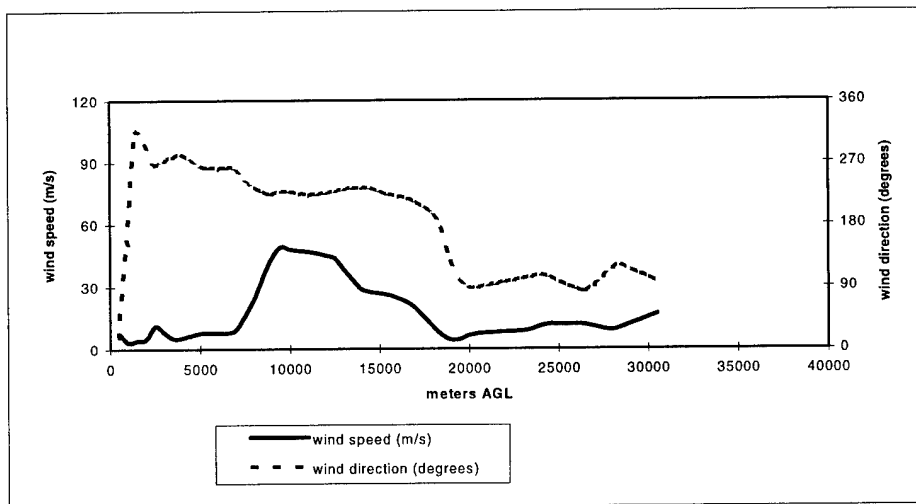


Figure 162. Ankara 920725-0000

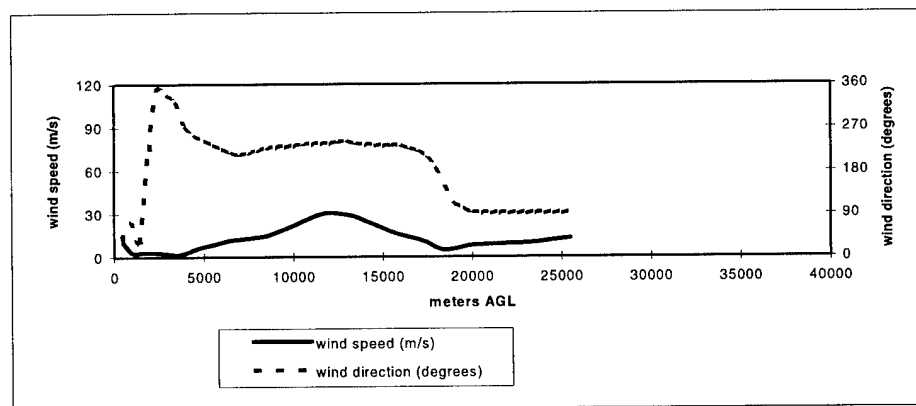
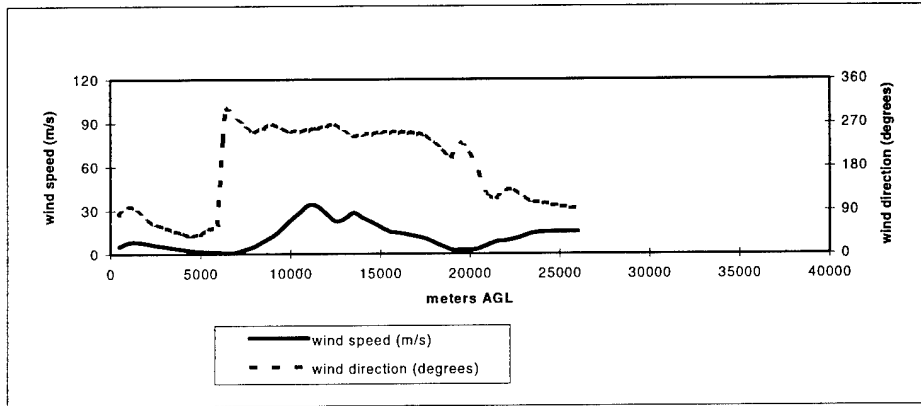
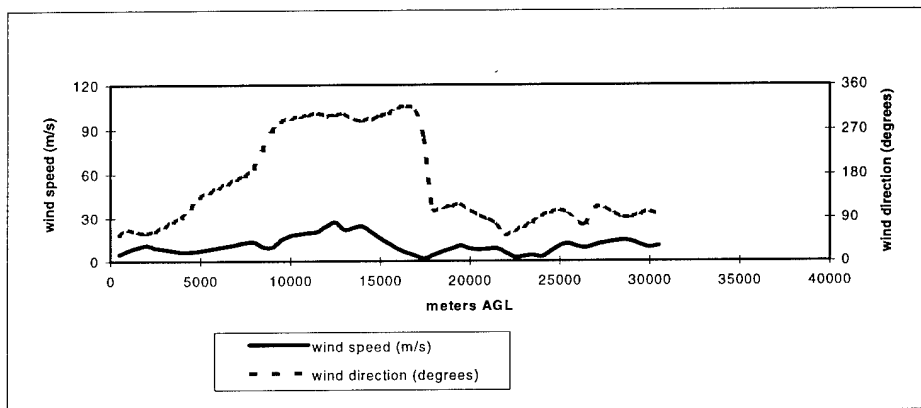


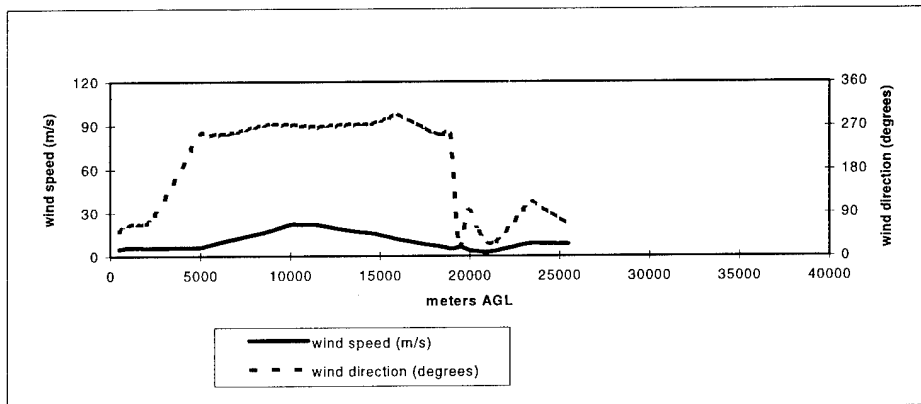
Figure 163. Ankara 920727-0000



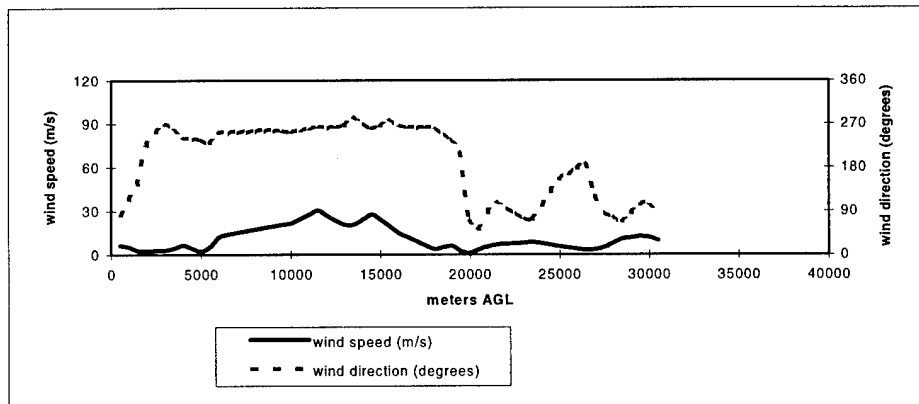
**Figure 164. Ankara 920802-1200**



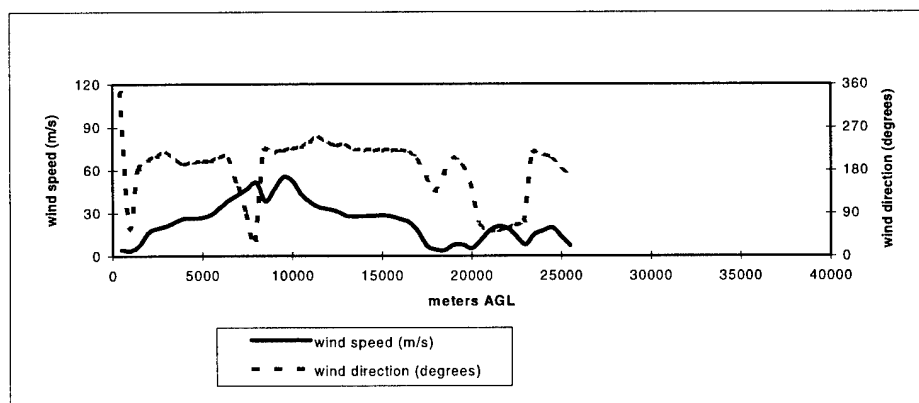
**Figure 165. Ankara 920811-1200**



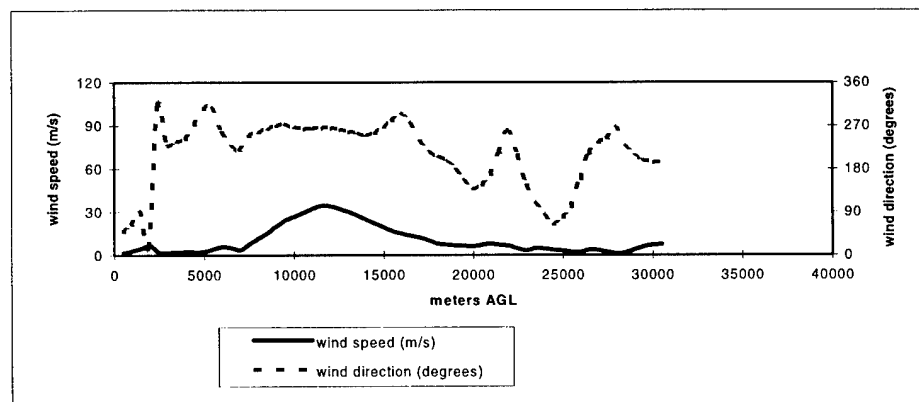
**Figure 166. Ankara 920820-0000**



**Figure 167. Ankara 920820-1200**



**Figure 168. Ankara 920907-1200**



**Figure 169. Ankara 920912-1200**

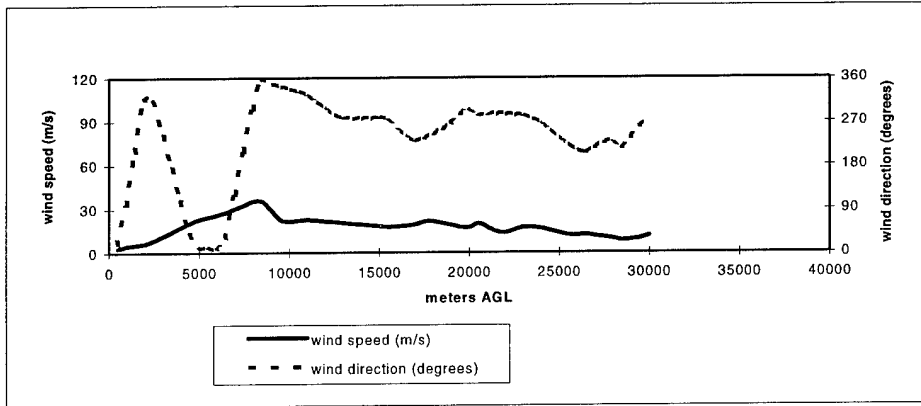


Figure 170. Ankara 920927-0000

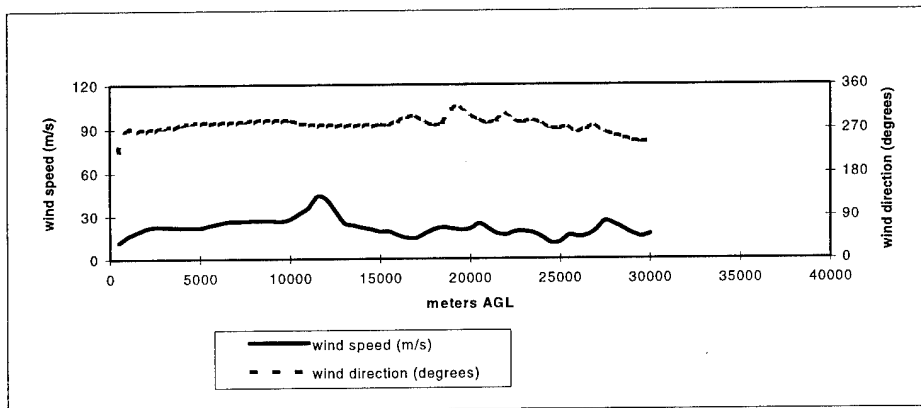


Figure 171. Ankara 921008-0000

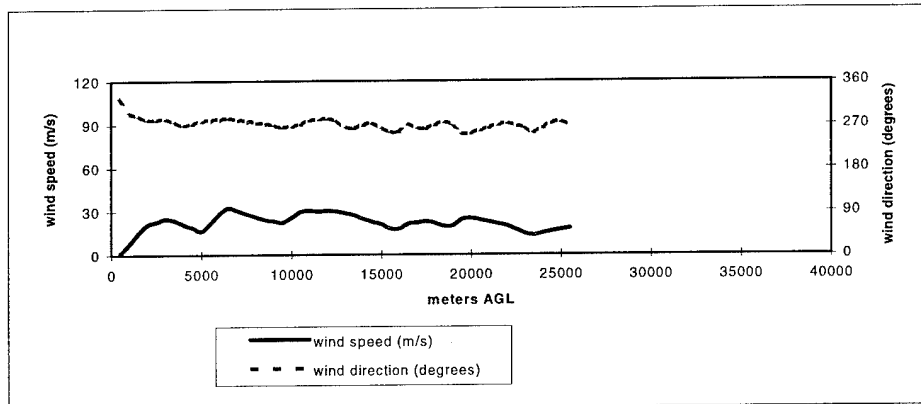
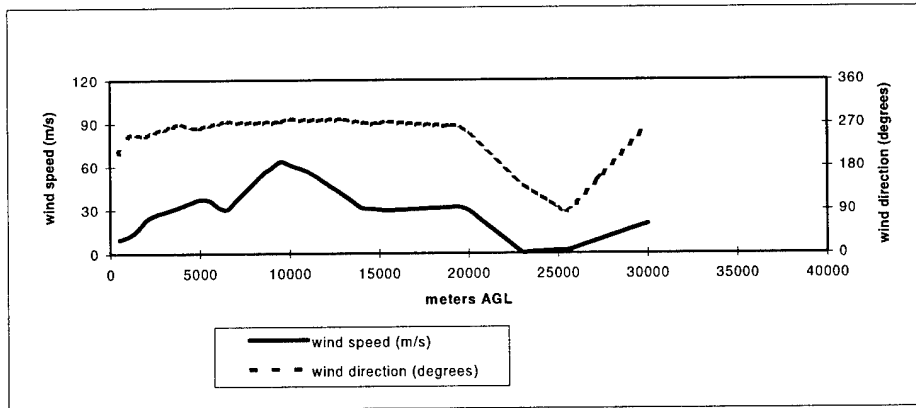
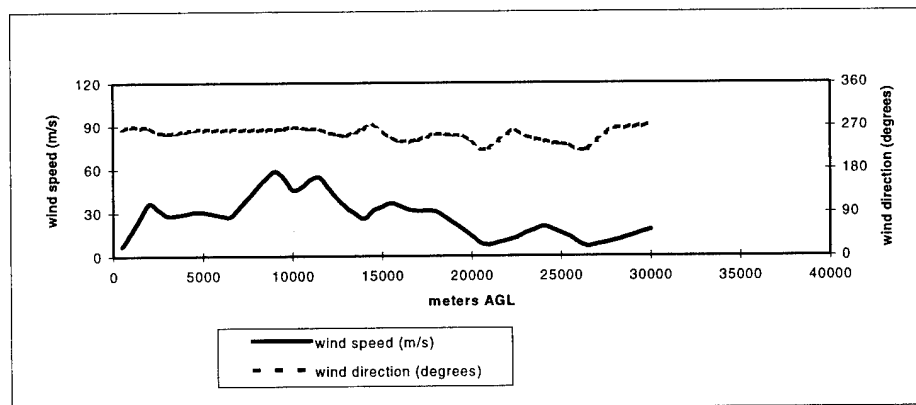


Figure 172. Ankara 921015-1200

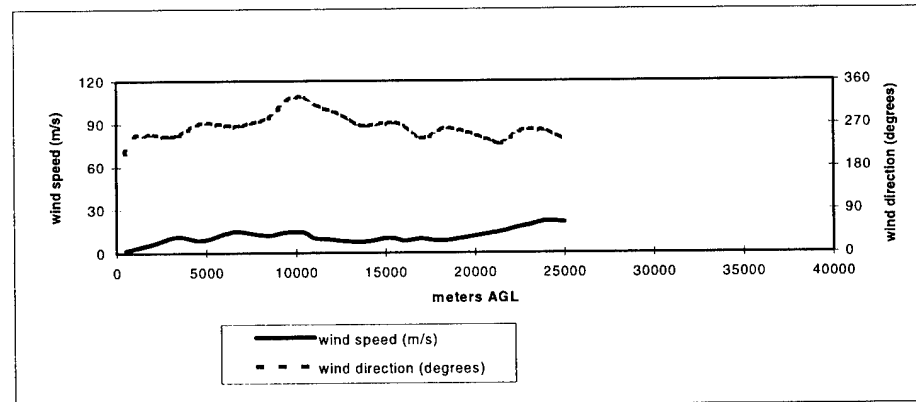




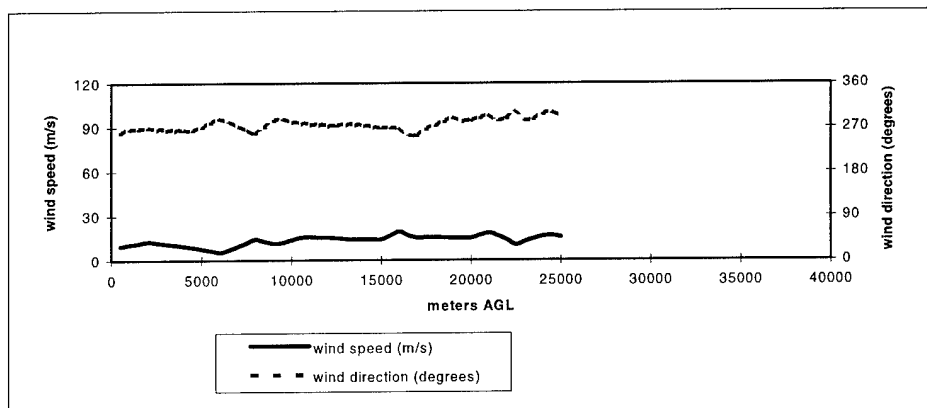
**Figure 173. Ankara 921023-1200**



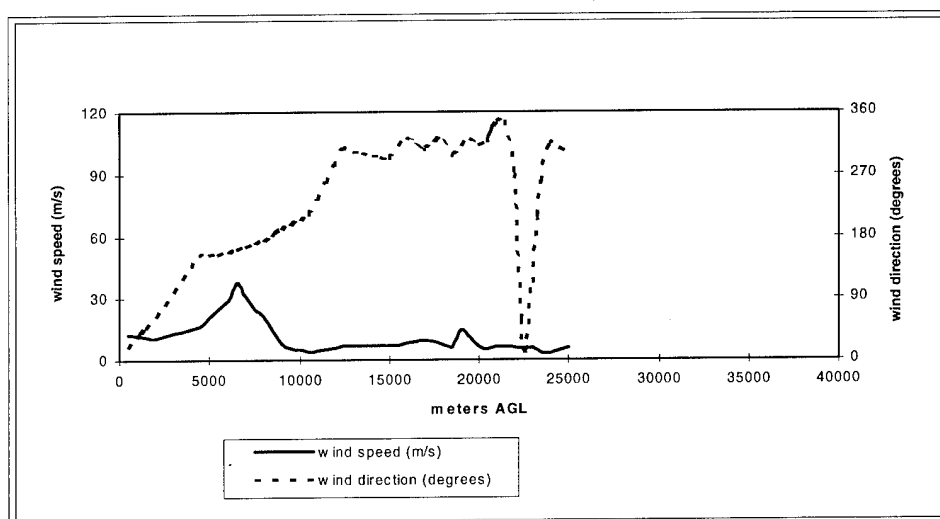
**Figure 174. Ankara 921024-1200**



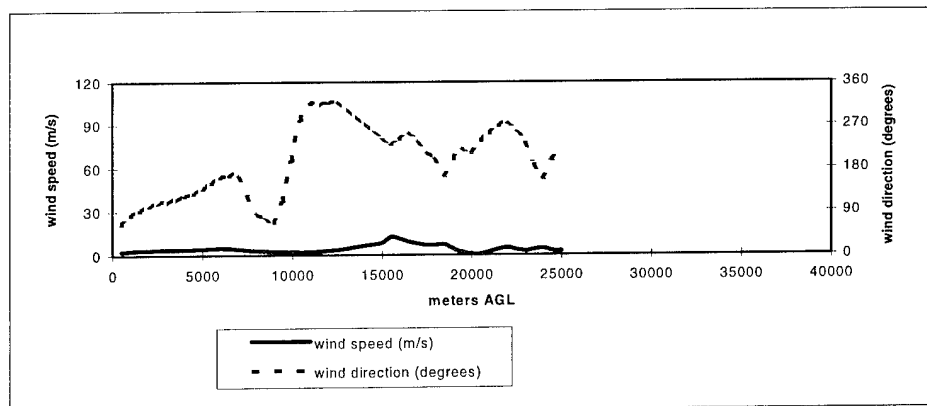
**Figure 175. Ankara 921112-1200**



**Figure 176. Ankara 921213-0000**



**Figure 177. Ankara 921215-0000**



**Figure 178. Ankara 921217-0000**

## 6.4 Dhahran, Saudi Arabia

**Table 7. Table of Spread Distances (m), Dhahran, Saudi Arabia**

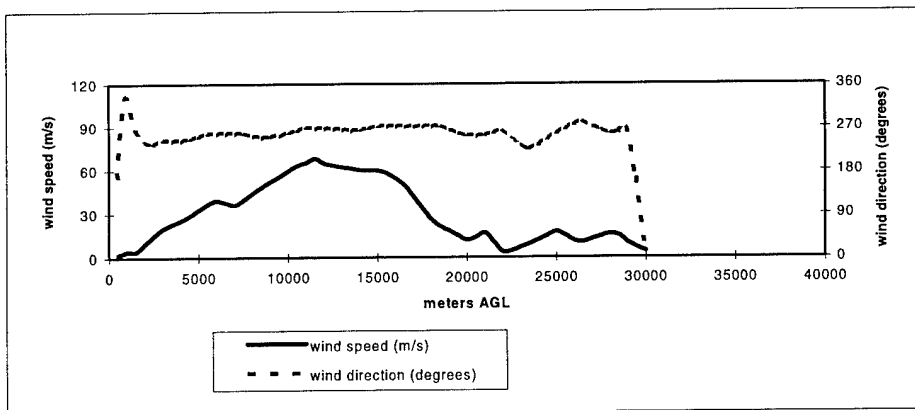
Order Statistic	Intercept Altitude					
	5 km			10 km		
	Spread Distance	Date/Time	Figure No.	Spread Distance	Date/Time	Figure No.
Minimum	275.	911019-1100	196	331.	920703-2300	219
5th percentile	3435.	920609-1100	217	7986.	920725-2300	223
10th percentile	5450.	920729-1200	224	10849.	910719-2300	190
25th percentile	8889.	921026-1100	237	19340.	920915-1200	231
Median	14630.	920916-1100	232	35001.	920509-2300	214
75th percentile	21139.	920318-1100	206	63122.	920328-2300	209
90th percentile	26311.	920311-1100	205	85543.	920320-2300	207
95th percentile	29012.	911222-1100	198	94684.	920206-2300	201
Maximum	40689.	920130-2300	200	135202.	920211-1100	202
Number of Valid Profiles	1195			1187		

Order Statistic	Intercept Altitude					
	20 km			30 km		
	Spread Distance	Date/Time	Figure No.	Spread Distance	Date/Time	Figure No.
Minimum	2712.	920709-2300	221	8910.	910915-2300	193
5th percentile	13416.	920903-2300	230	31434.	921016-2300	235
10th percentile	20314.	910606-2300	186	40820.	920826-1100	229
25th percentile	37204.	920824-2300	228	57177.	910724-2300	191
Median	77871.	921022-1100	236	84140.	910506-2300	183
75th percentile	140085.	920503-1100	212	143864.	920503-2300	213
90th percentile	175657.	920329-1100	210	187829.	921229-1100	239
95th percentile	199465.	910130-2300	180	215704.	920325-1100	208
Maximum	270108.	921217-2300	238	277962.	920211-1100	202
Number of Valid Profiles	1057			450		

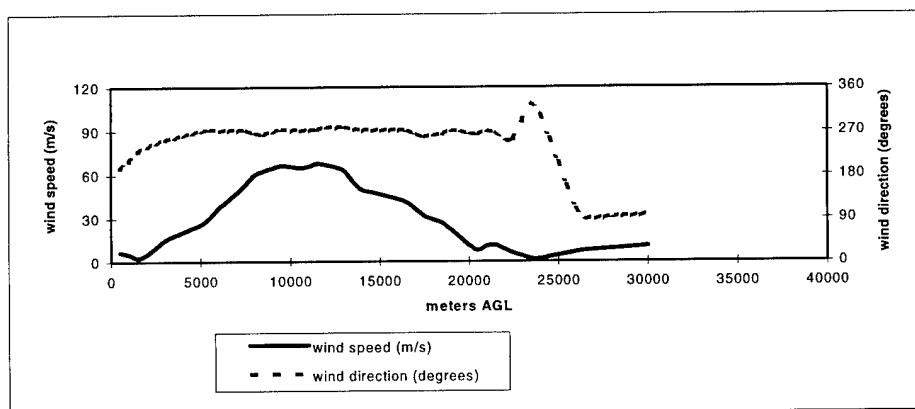
**Table 8. Table of Travel Distances (m), Dhahran, Saudi Arabia**

Order Statistic	Intercept Altitude					
	5 km			10 km		
	Travel Distance	Date/Time	Figure No.	Travel Distance	Date/Time	Figure No.
Minimum	123.	911019-1100	196	313.	910616-1100	188
5th percentile	1220.	911115-1100	197	2695.	910911-2300	192
10th percentile	1881.	920804-2300	226	3521.	920926-2300	233
25th percentile	3110.	910615-1100	187	6429.	920819-2300	227
Median	5049.	910923-1100	194	11352.	920509-2300	214
75th percentile	7318.	920626-1100	218	20079.	910522-2300	185
90th percentile	9035.	910324-2300	181	27073.	910412-2300	182
95th percentile	9930.	910412-2300	182	30007.	920214-2300	203
Maximum	13931.	920130-2300	200	42982.	920211-1100	202
Number of Valid Profiles	1195			1187		

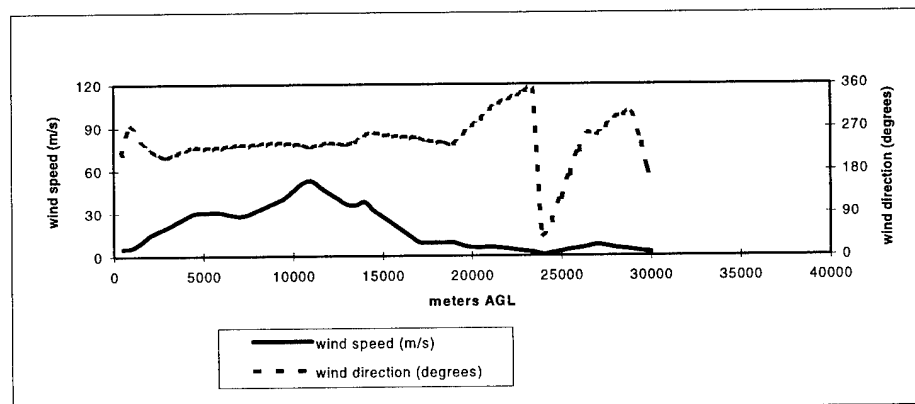
Order Statistic	Intercept Altitude					
	20 km			30 km		
	Travel Distance	Date/Time	Figure No.	Travel Distance	Date/Time	Figure No.
Minimum	260.	920926-2300	233	759.	910923-2300	195
5th percentile	3927.	920731-1100	225	7964.	920707-1100	220
10th percentile	5806.	920930-2300	234	9949.	920720-1100	222
25th percentile	10219.	910712-1100	189	14310.	910517-1100	184
Median	22261.	920509-2300	214	24393.	920520-2300	216
75th percentile	39464.	920511-1100	215	40444.	920407-1100	211
90th percentile	49814.	920117-2300	199	51504.	920304-1100	204
95th percentile	56309.	910130-2300	180	58593.	910124-1100	179
Maximum	75785.	921217-2300	238	76779.	920211-1100	202
Number of Valid Profiles	1057			450		



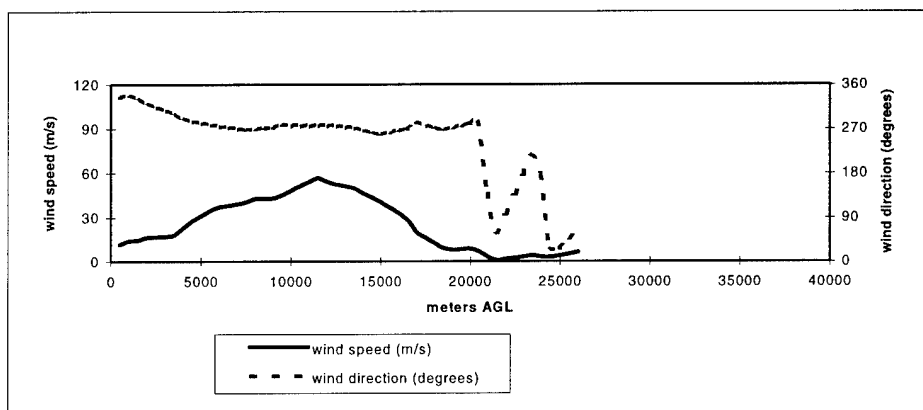
**Figure 179. Dhahran 910124-1100**



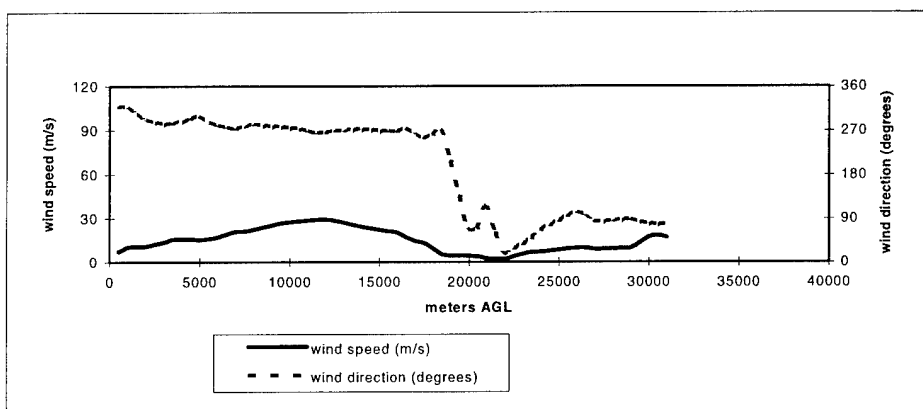
**Figure 180. Dhahran 910130-2300**



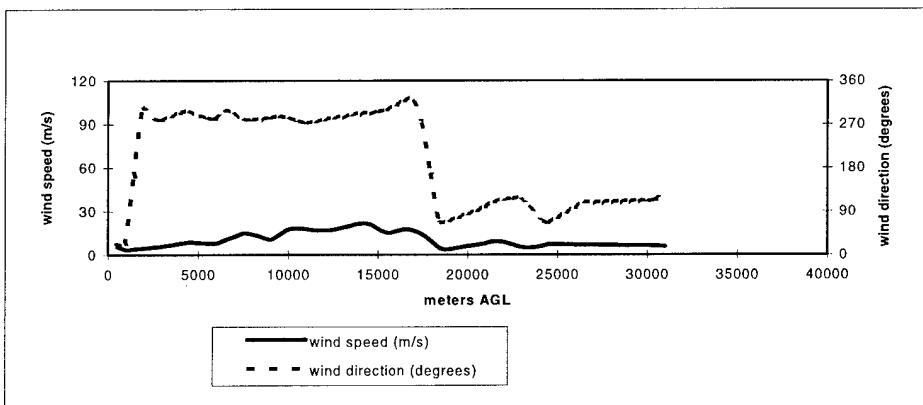
**Figure 181. Dhahran 910324-2300**



**Figure 182. Dhahran 910412-2300**



**Figure 183. Dhahran 910506-2300**



**Figure 184. Dhahran 910517-1100**

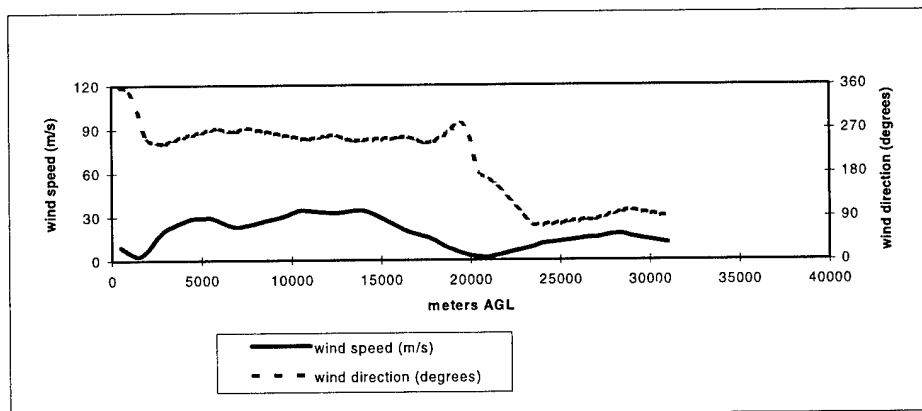


Figure 185. Dhahran 910522-2300

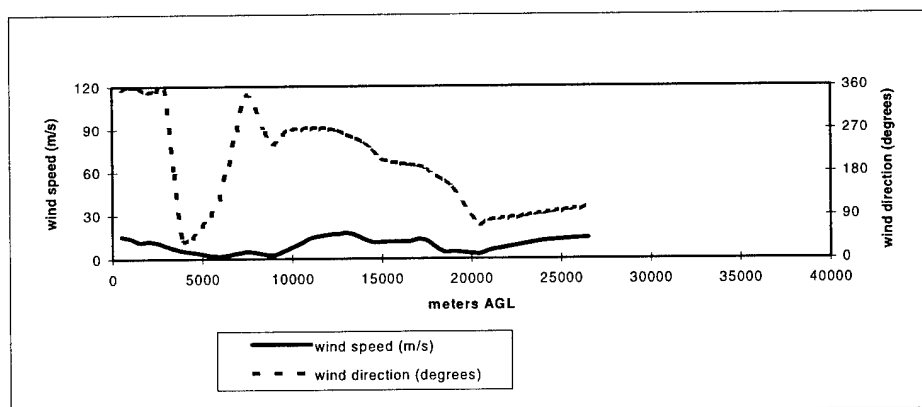


Figure 186. Dhahran 910606-2300

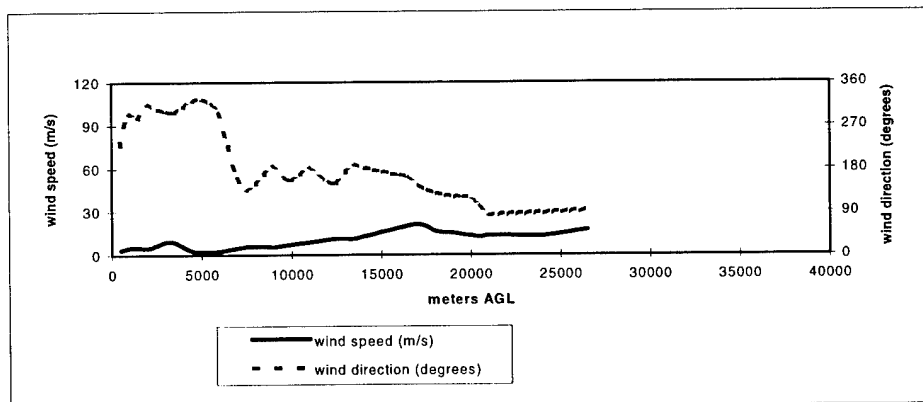
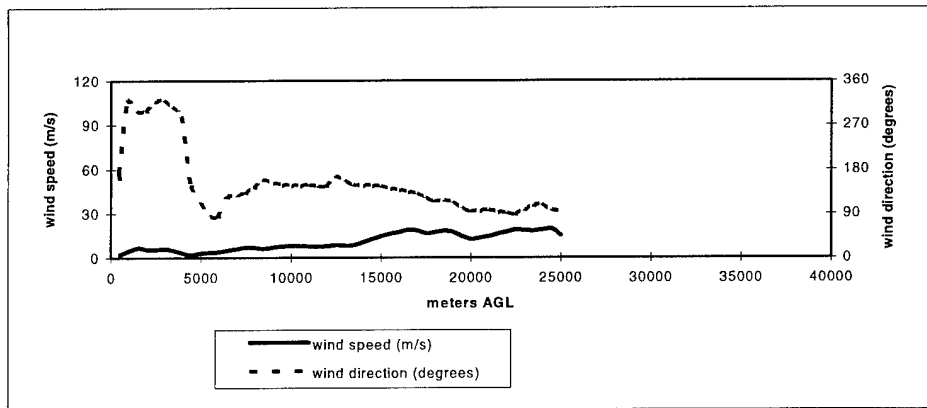
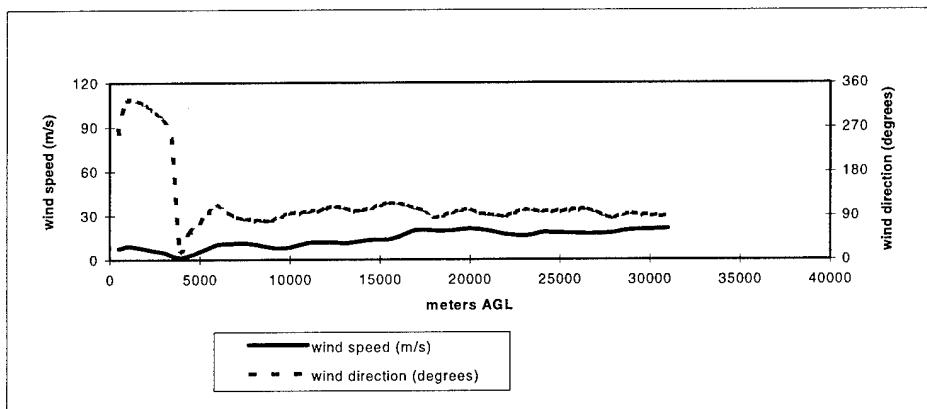


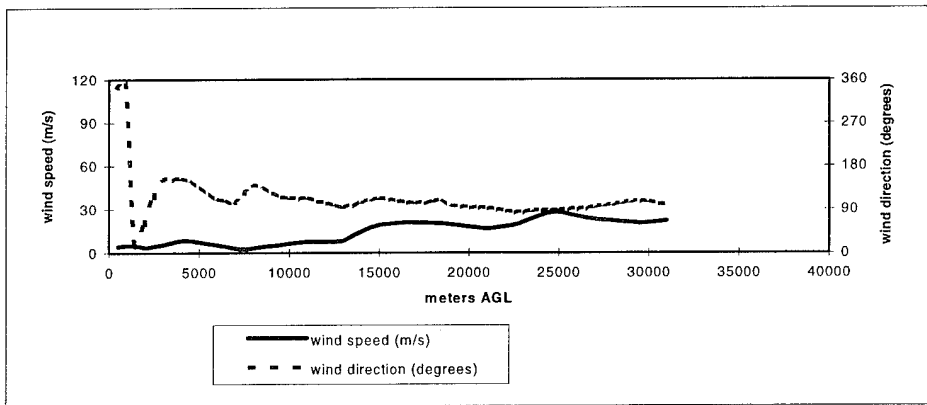
Figure 187. Dhahran 910615-1100



**Figure 188. Dhahran 910616-1100**



**Figure 189. Dhahran 910712-1100**



**Figure 190. Dhahran 910719-2300**



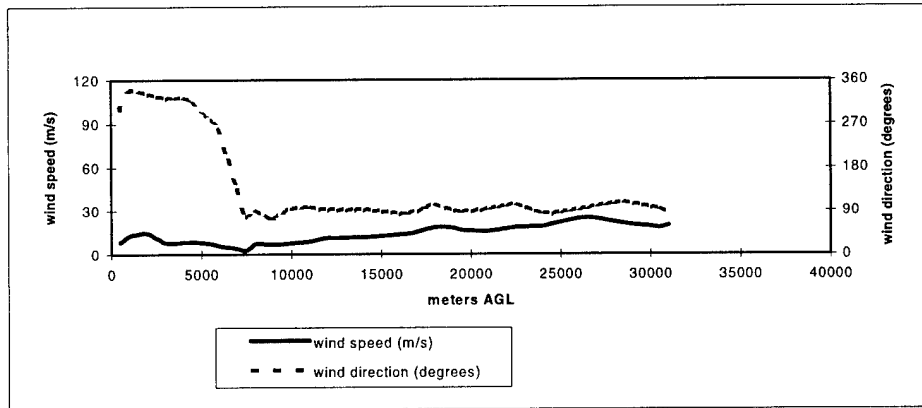


Figure 191. Dhahran 910724-2300

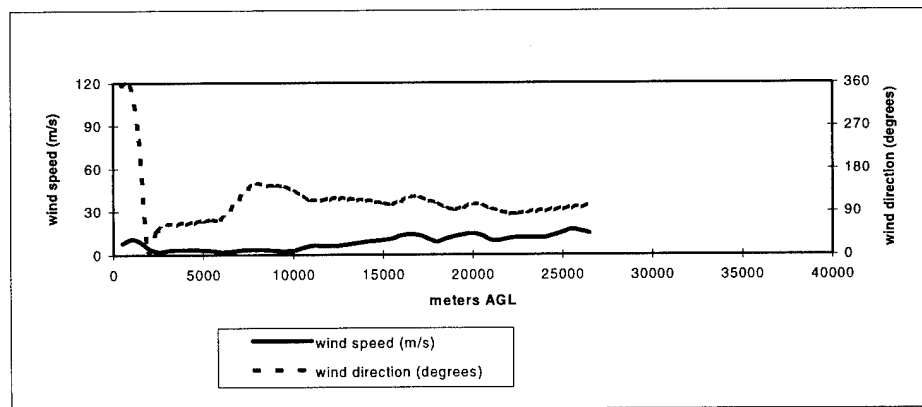


Figure 192. Dhahran 910911-2300

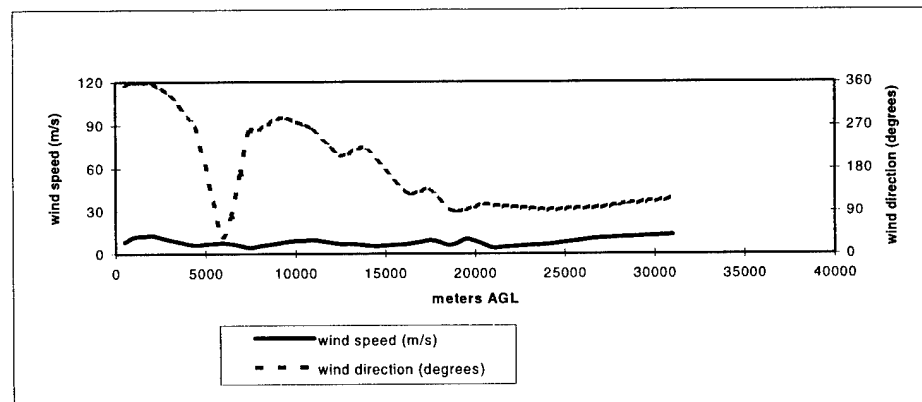
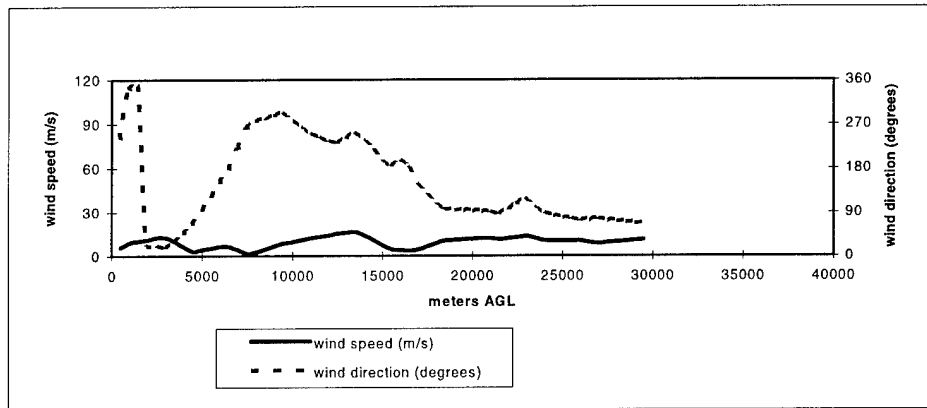
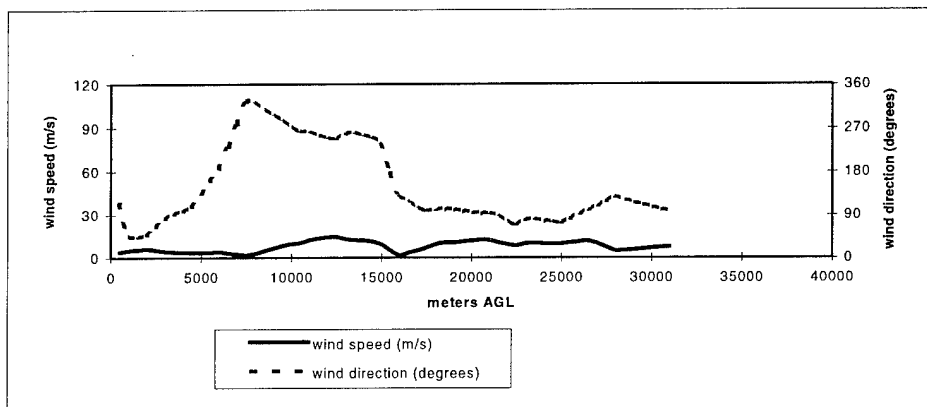


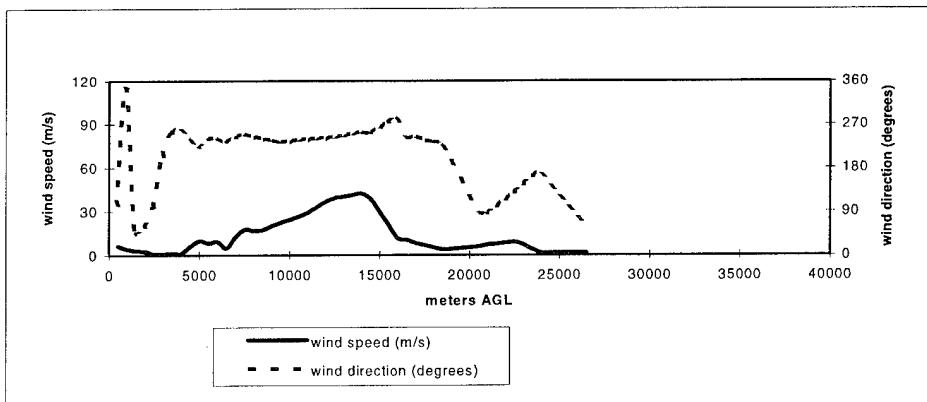
Figure 193. Dhahran 910915-2300



**Figure 194. Dhahran 910923-1100**



**Figure 195. Dhahran 910923-2300**



**Figure 196. Dhahran 911019-1100**

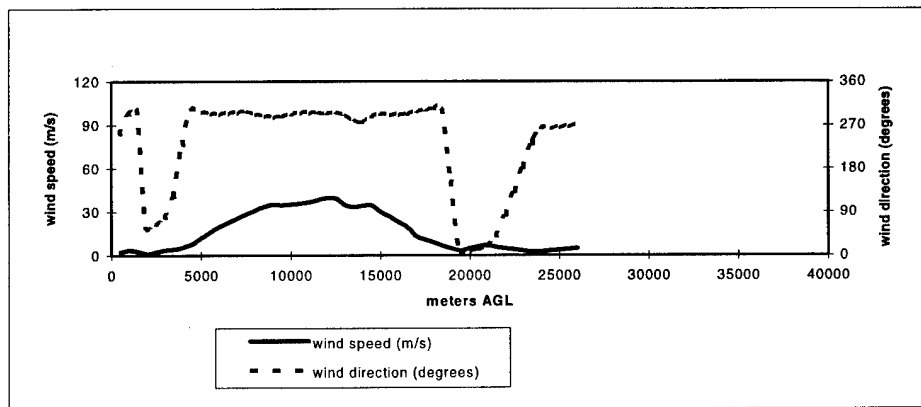


Figure 197. Dhahran 911115-1100

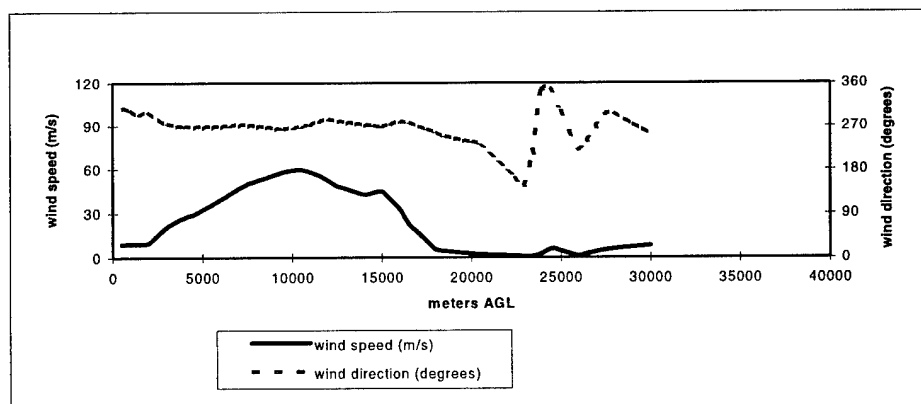


Figure 198. Dhahran 911222-1100

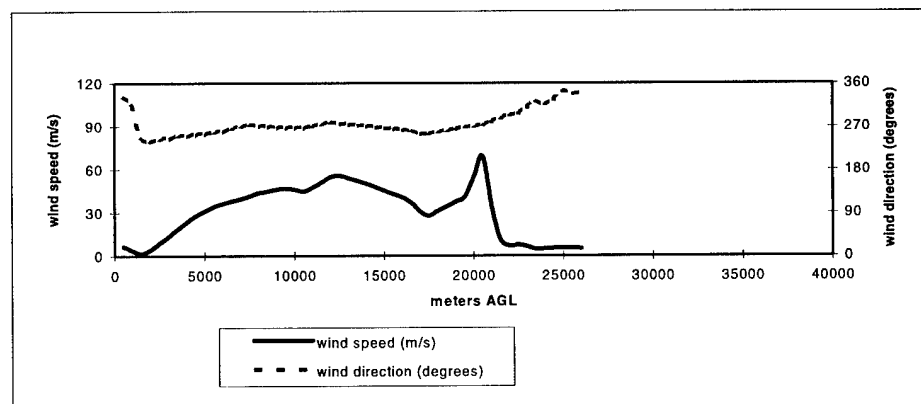
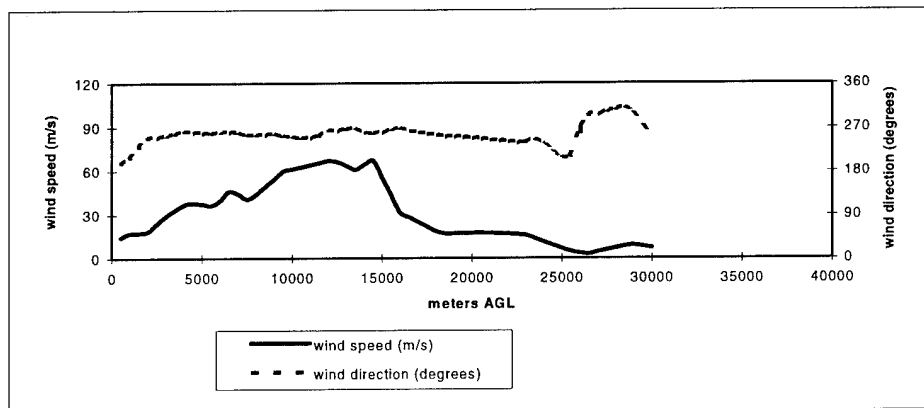
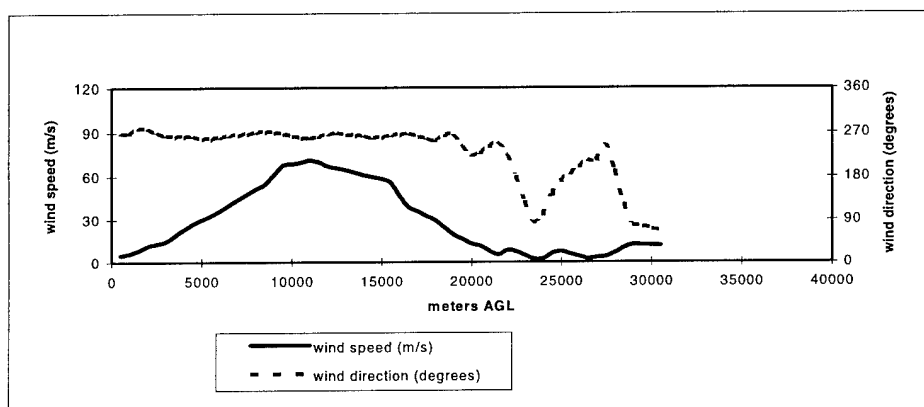


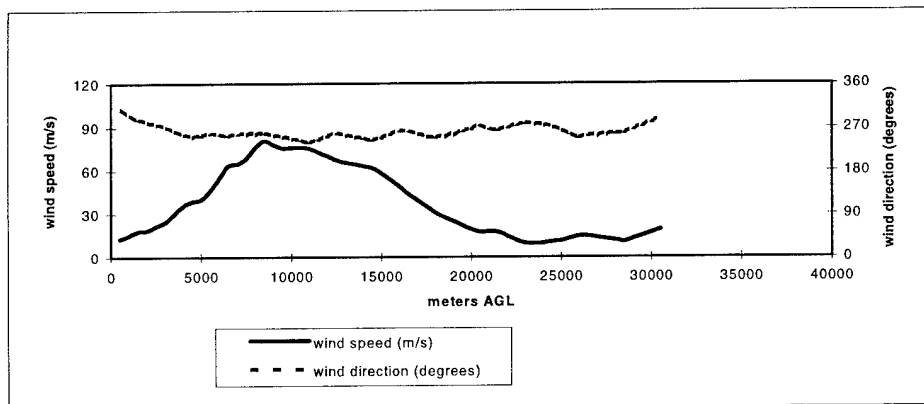
Figure 199. Dhahran 920117-2300



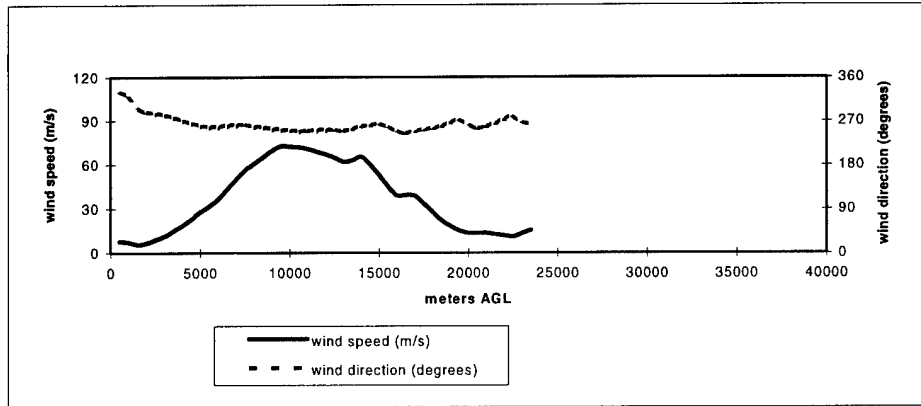
**Figure 200. Dhahran 920130-2300**



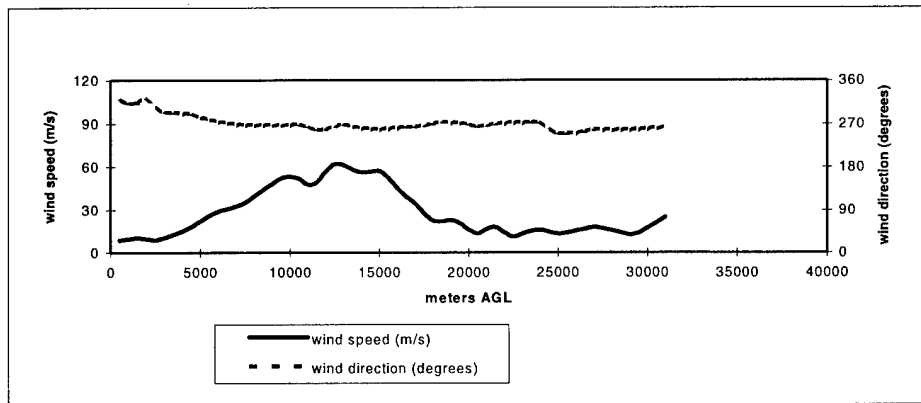
**Figure 201. Dhahran 920206-2300**



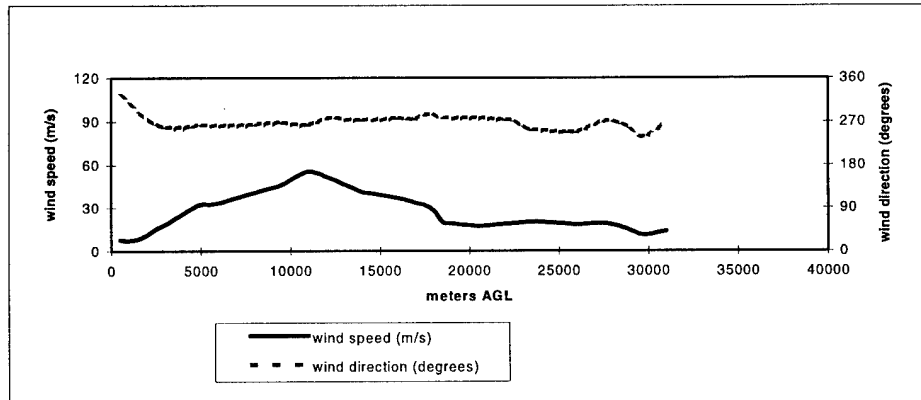
**Figure 202. Dhahran 920211-1100**



**Figure 203. Dhahran 920214-2300**



**Figure 204. Dhahran 920304-1100**



**Figure 205. Dhahran 920311-1100**

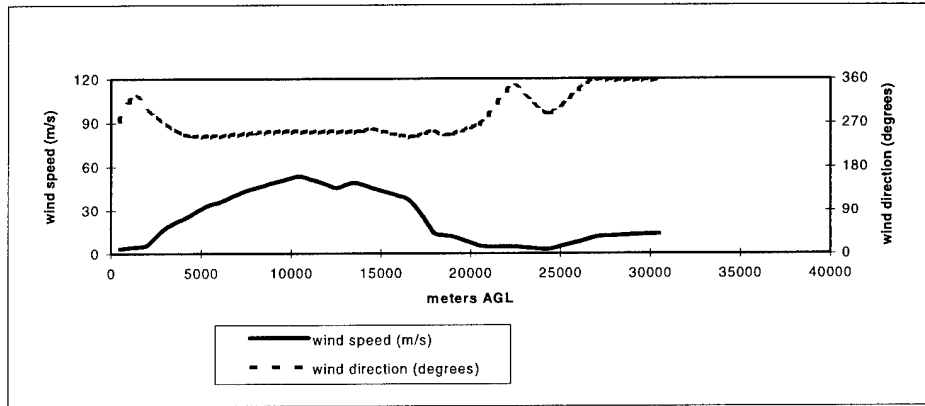


Figure 206. Dhahran 920318-1100

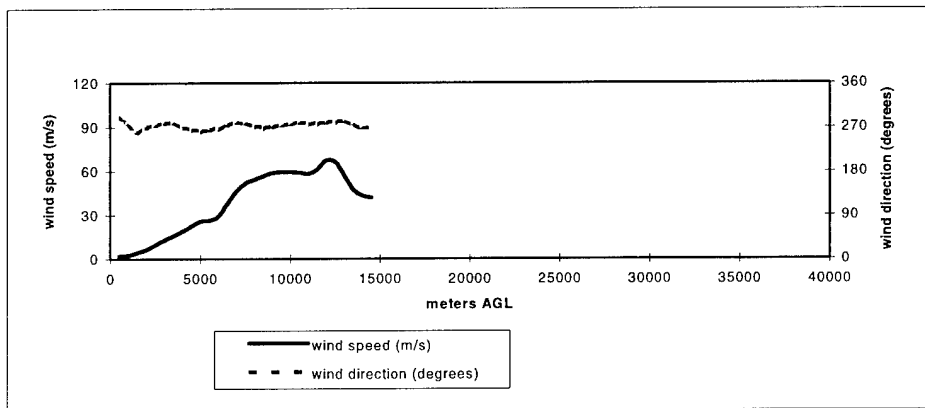


Figure 207. Dhahran 920320-2300

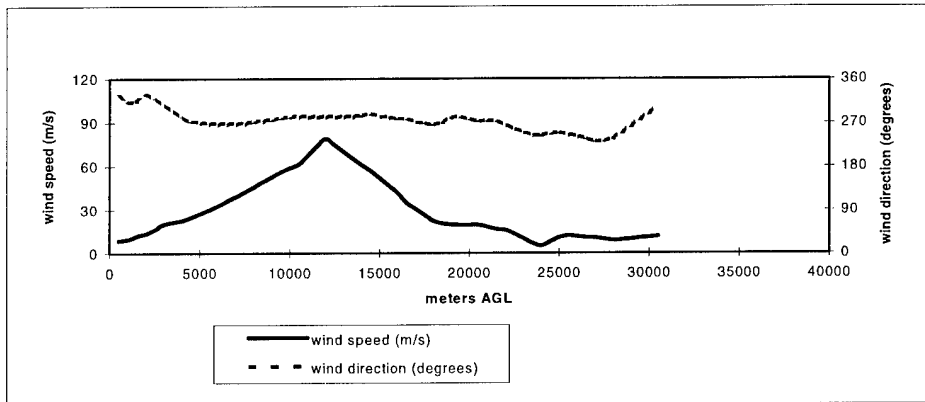


Figure 208. Dhahran 920325-1100

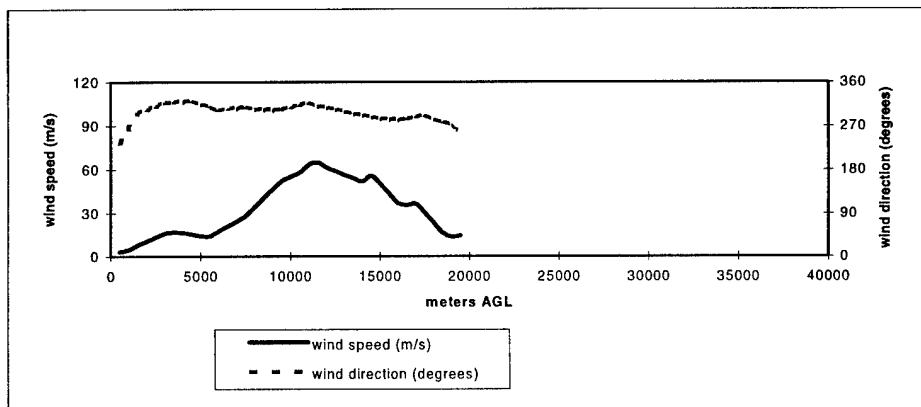


Figure 209. Dhahran 920328-2300

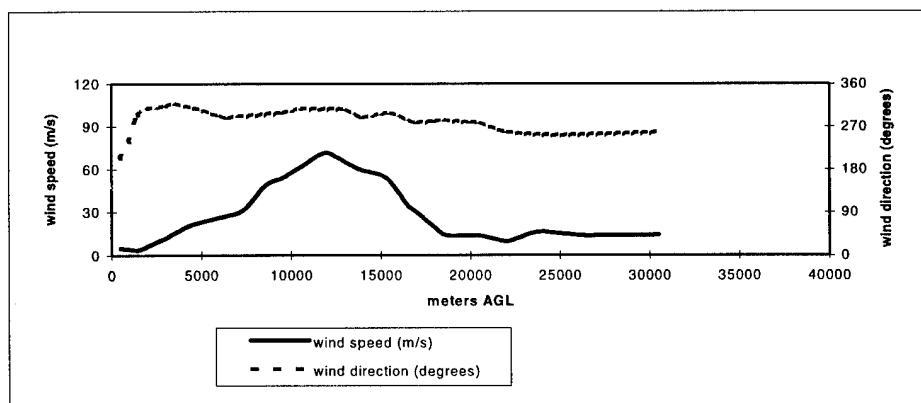


Figure 210. Dhahran 920329-1100

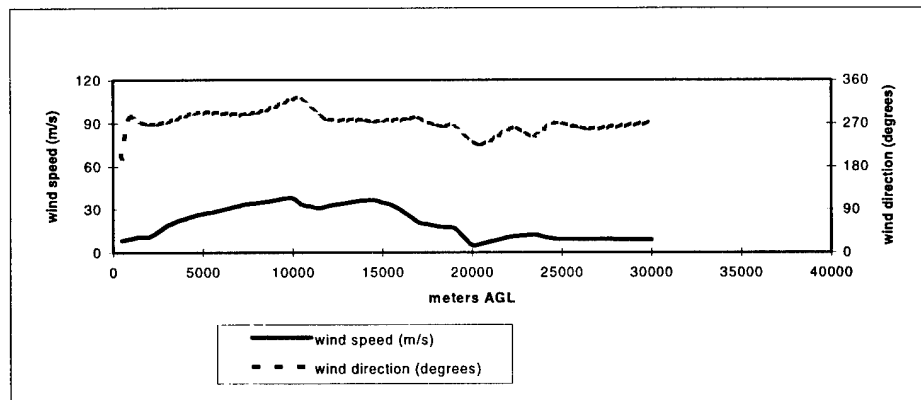


Figure 211. Dhahran 920407-1100

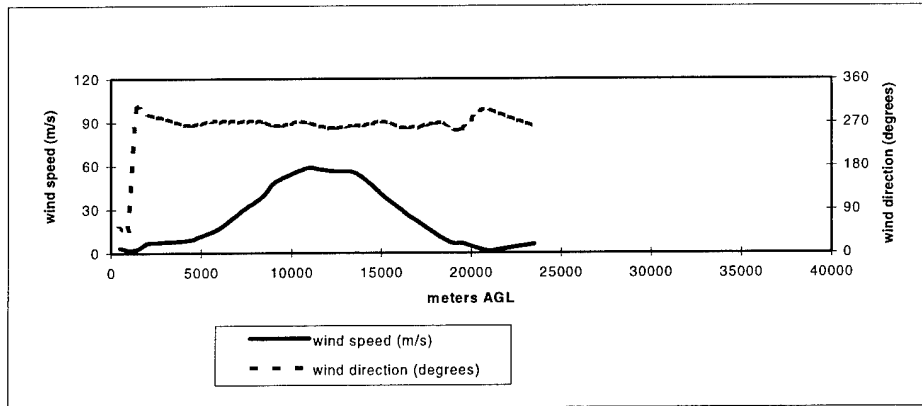


Figure 212. Dhahran 920503-1100

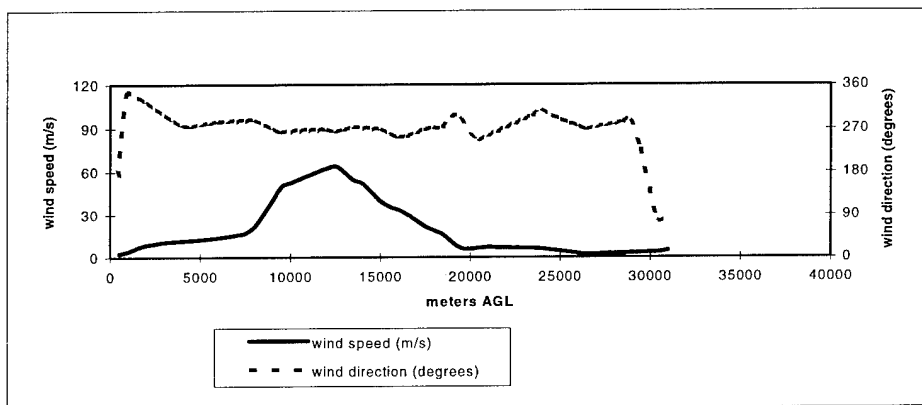


Figure 213. Dhahran 920503-2300

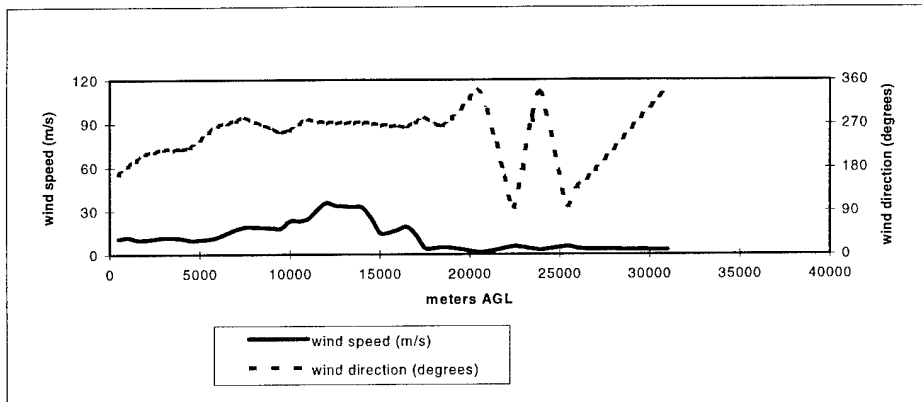
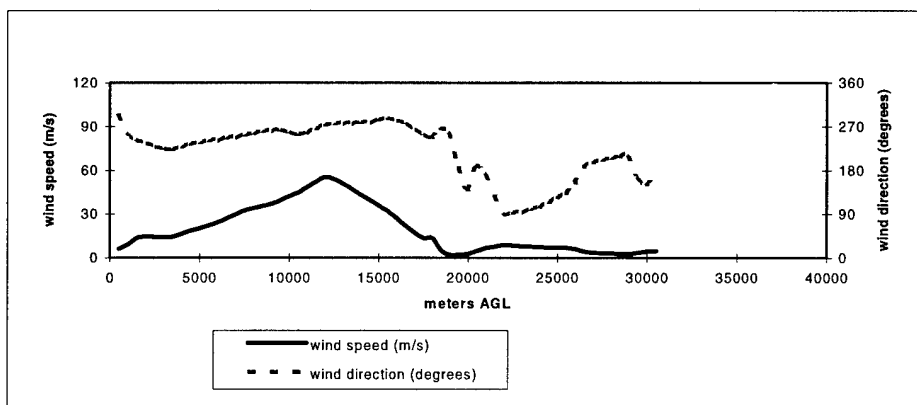
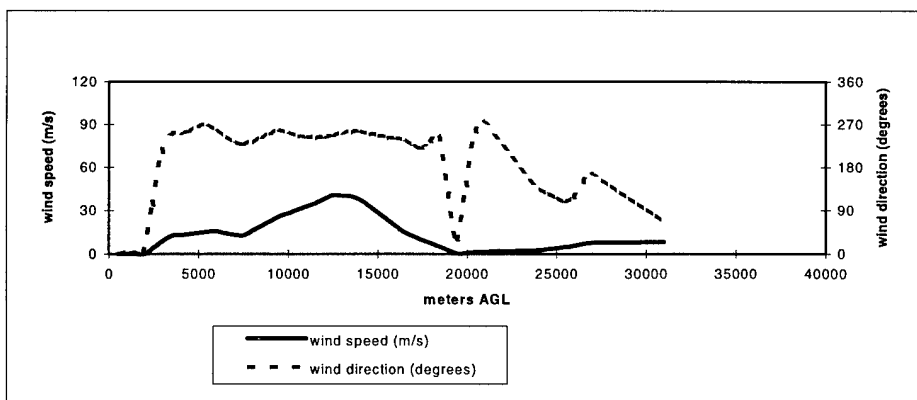


Figure 214. Dhahran 920509-2300

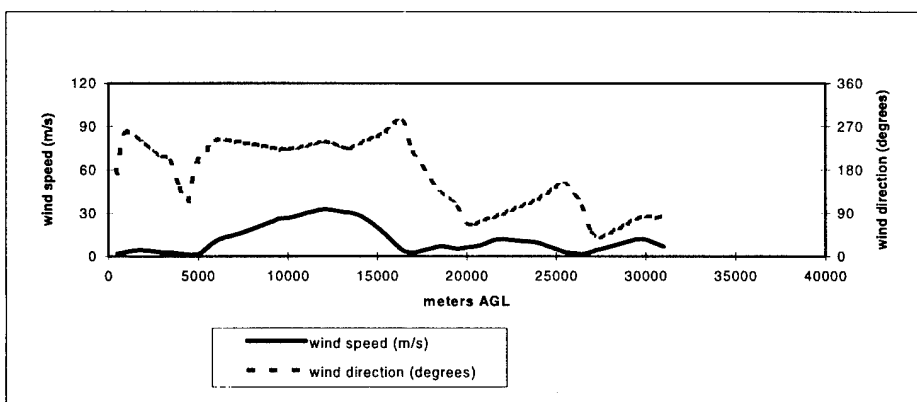




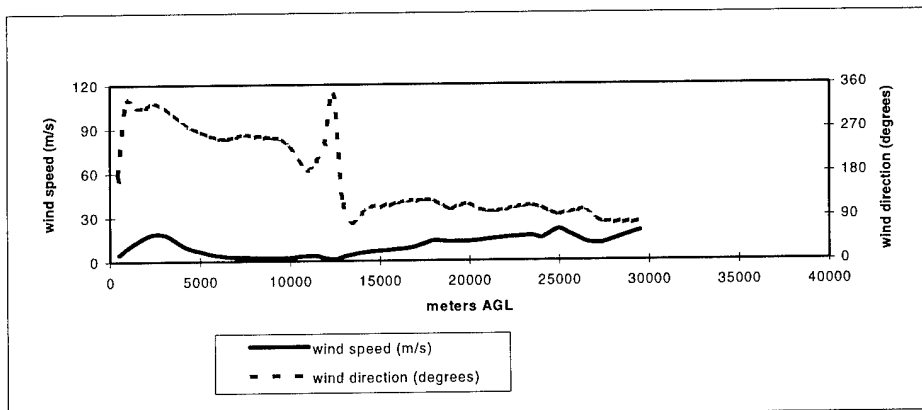
**Figure 215. Dhahran 920511-1100**



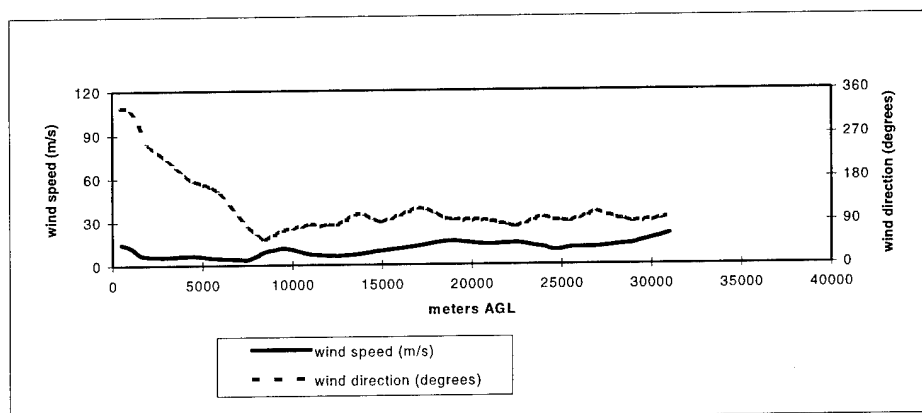
**Figure 216. Dhahran 920520-2300**



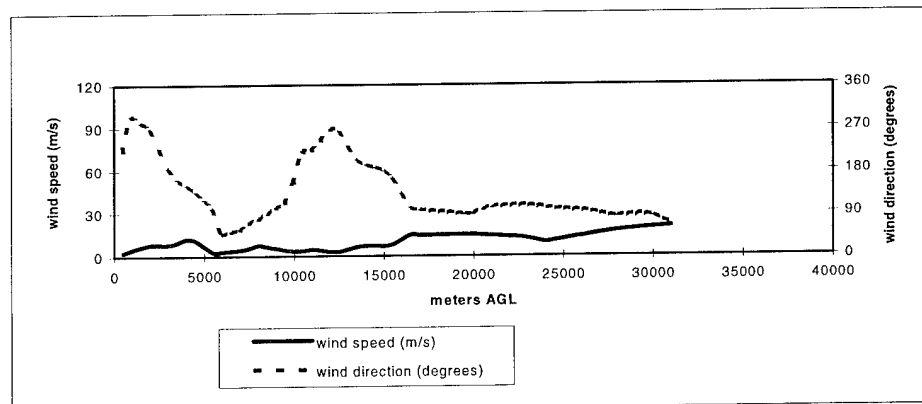
**Figure 217. Dhahran 920609-1100**



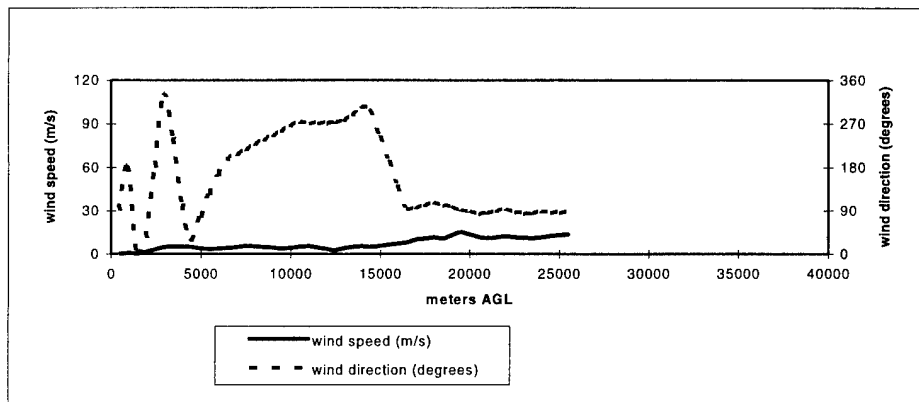
**Figure 218. Dhahran 920626-1100**



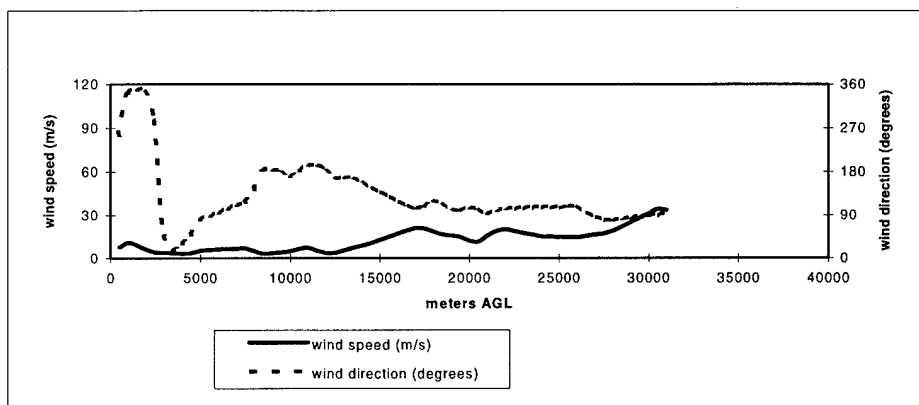
**Figure 219. Dhahran 920703-2300**



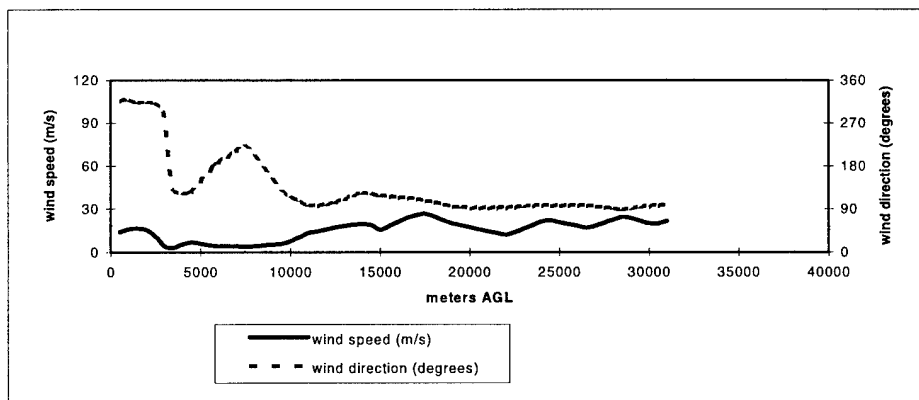
**Figure 220. Dhahran 920707-1100**



**Figure 221. Dhahran 920709-2300**



**Figure 222. Dhahran 920720-1100**



**Figure 223. Dhahran 920725-2300**

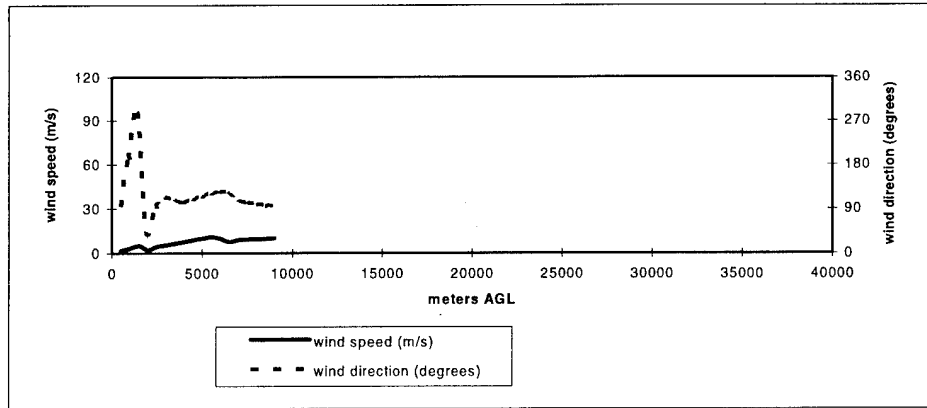


Figure 224. Dhahran 920729-1200

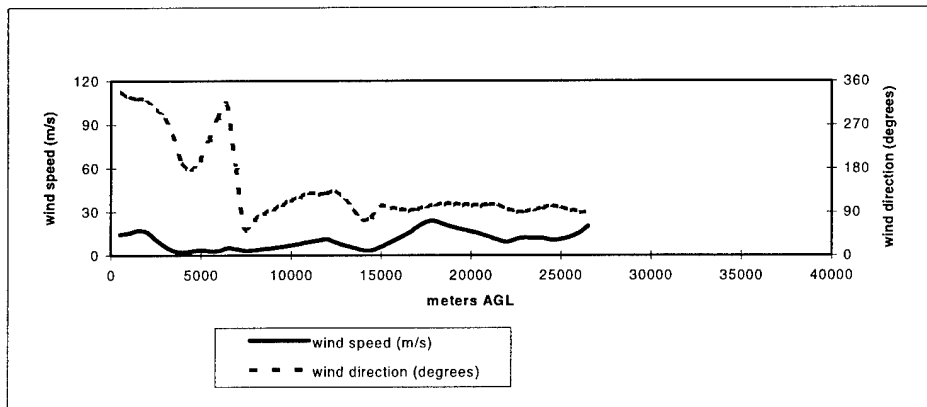


Figure 225. Dhahran 920731-1100

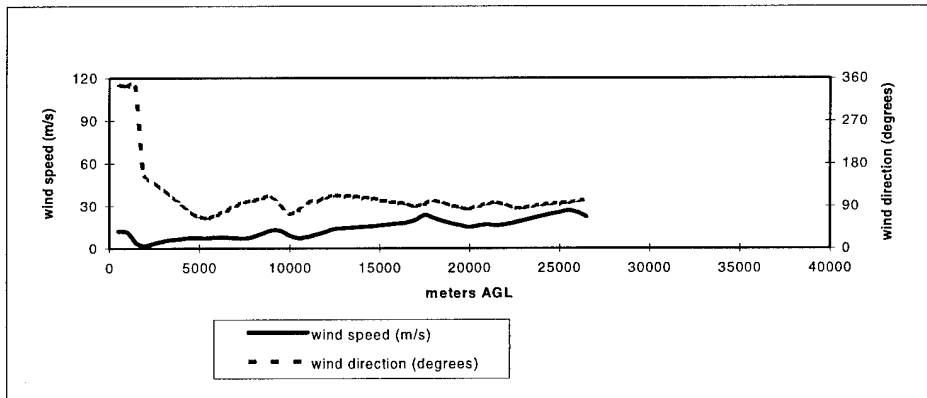


Figure 226. Dhahran 920804-2300

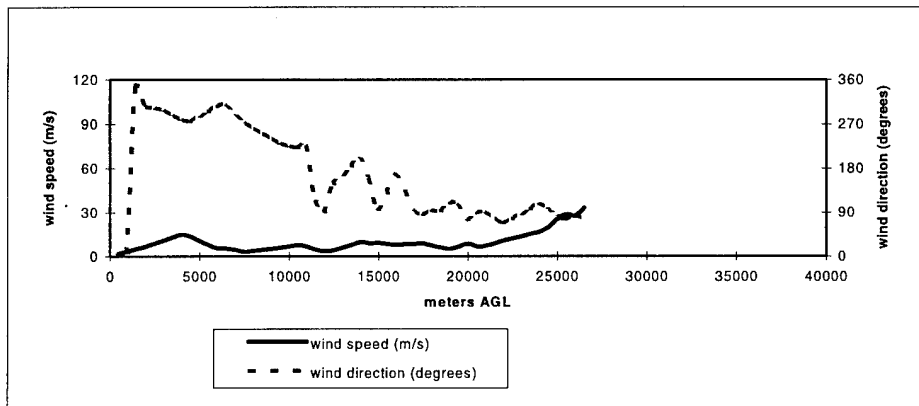


Figure 227. Dhahran 920819-2300

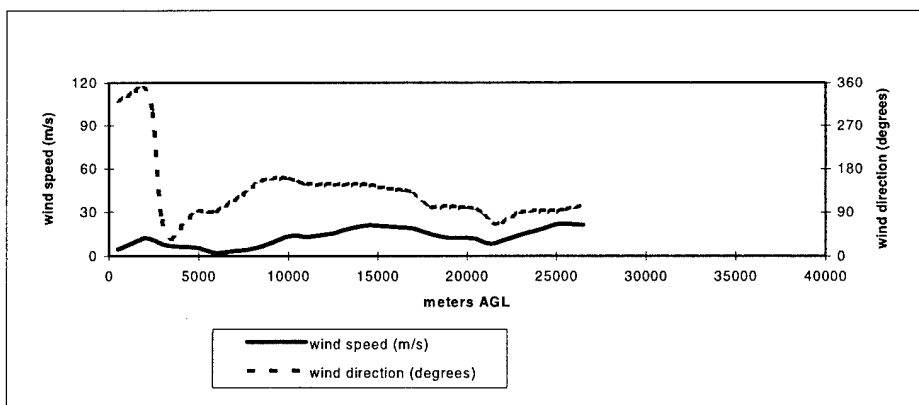


Figure 228. Dhahran 920824-2300

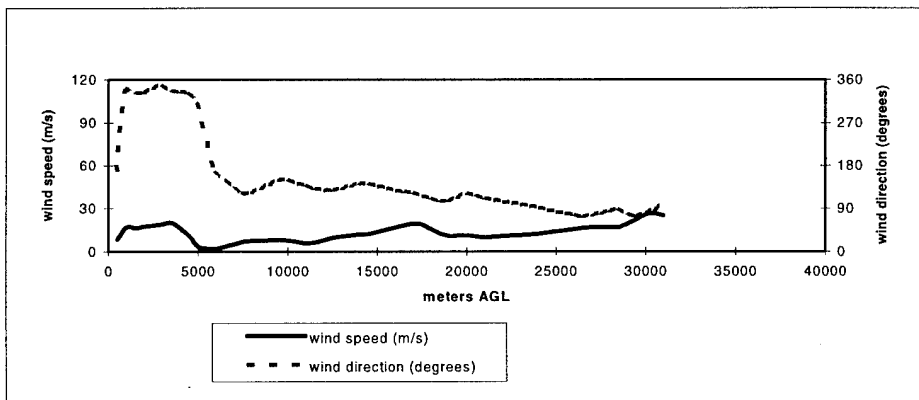


Figure 229. Dhahran 920826-1100

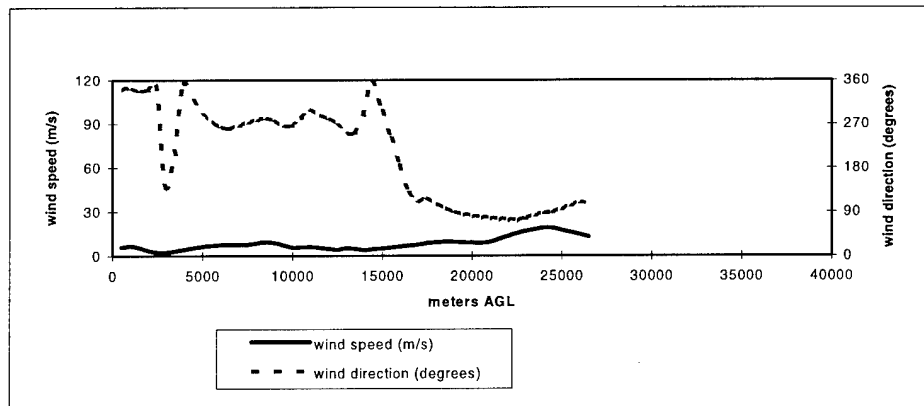


Figure 230. Dhahran 920903-2300

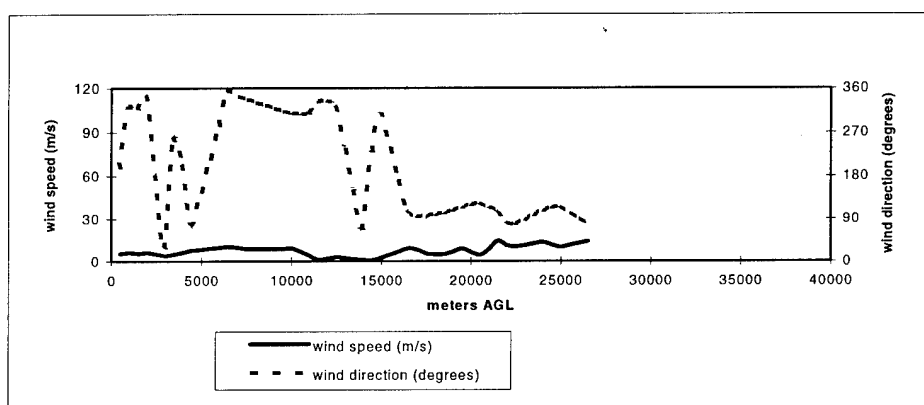


Figure 231. Dhahran 920915-1200

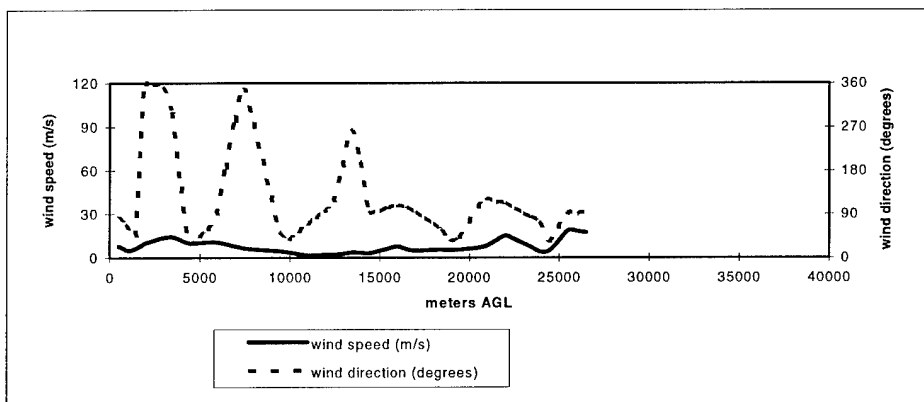
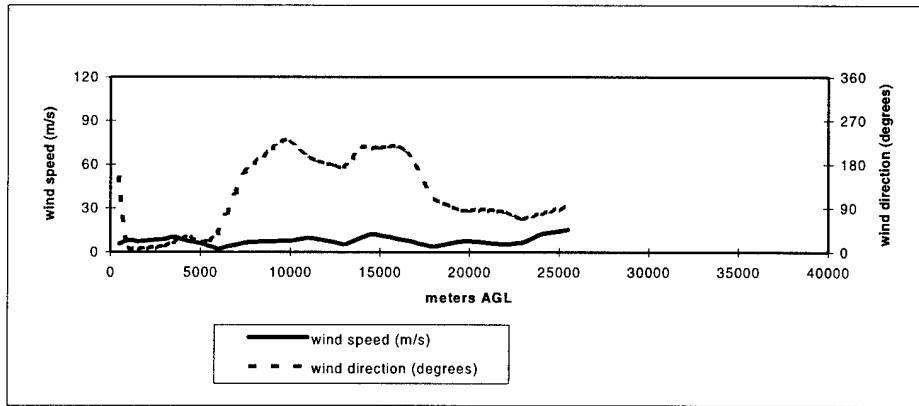
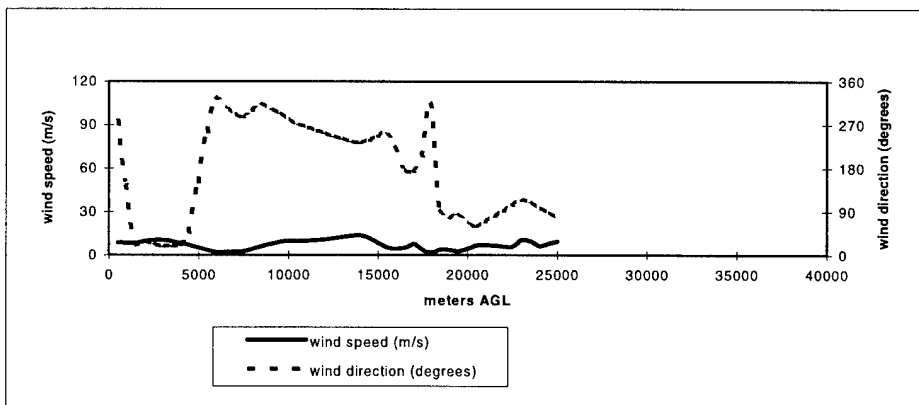


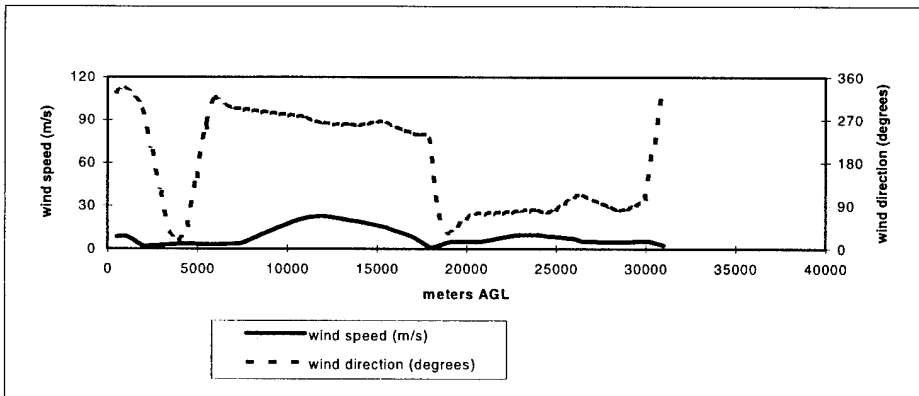
Figure 232. Dhahran 920916-1100



**Figure 233. Dhahran 920926-2300**



**Figure 234. Dhahran 920930-2300**



**Figure 235. Dhahran 921016-2300**

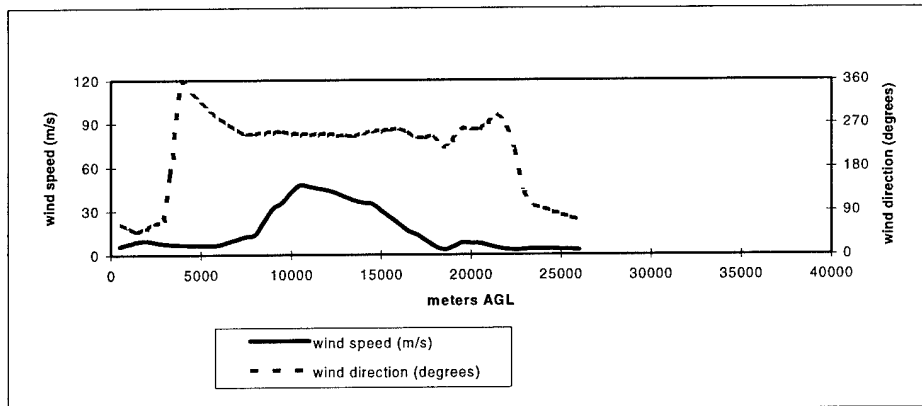


Figure 236. Dhahran 921022-1100

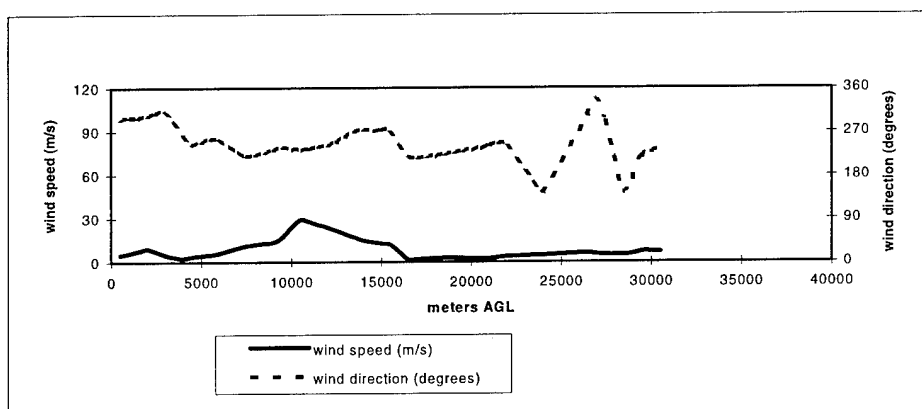


Figure 237. Dhahran 921026-1100

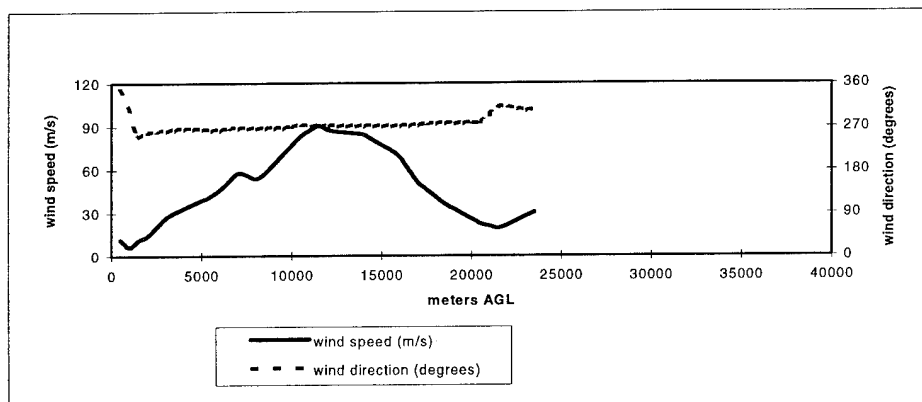


Figure 238. Dhahran 921217-2300



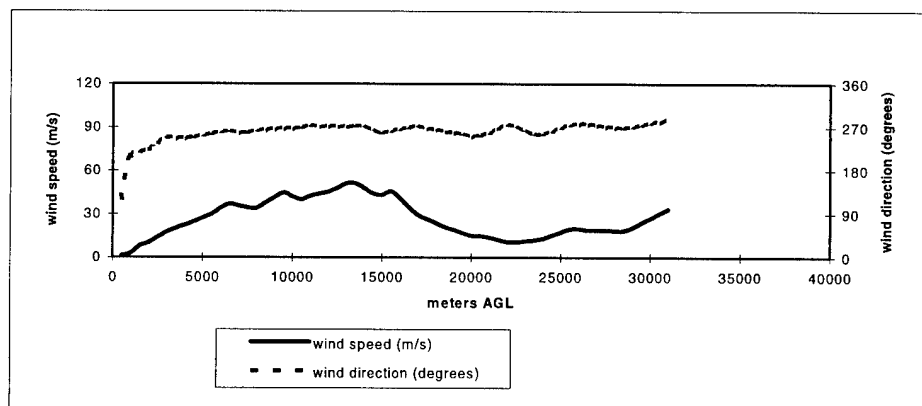


Figure 239. Dhahran 921229-1100

## 6.5 Riyadh, Saudi Arabia

**Table 9. Table of Spread Distances (m), Riyadh, Saudi Arabia**

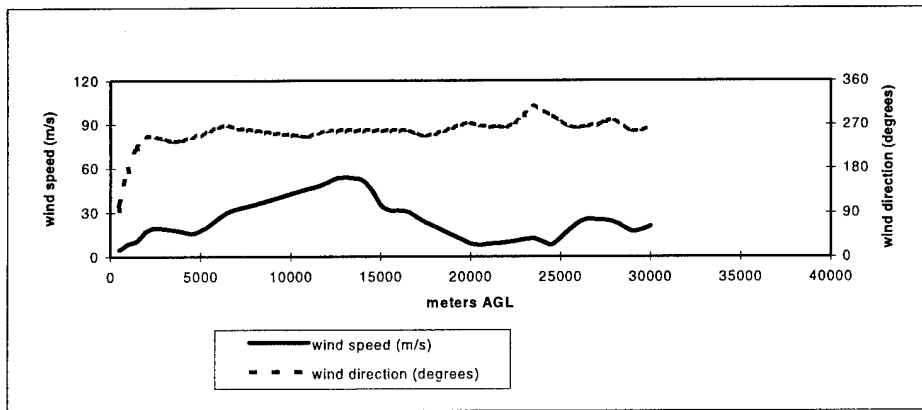
Order Statistic	Intercept Altitude					
	5 km			10 km		
	Spread Distance	Date/Time	Figure No.	Spread Distance	Date/Time	Figure No.
Minimum	242.	910823-1200	262	318.	920813-1100	283
5th percentile	3425.	911122-2300	270	5568.	920823-1100	285
10th percentile	4869.	910424-2300	248	8389.	920929-2300	290
25th percentile	7595.	911020-2300	268	13451.	920927-2300	289
Median	11238.	910916-1100	263	23184.	911004-2300	266
75th percentile	15768.	910201-1200	242	40761.	911111-2300	269
90th percentile	21991.	911201-1100	271	69052.	910412-1100	246
95th percentile	25875.	921225-2300	300	79390.	911203-1200	273
Maximum	43910.	910305-2300	244	138289.	910126-2300	241
Number of Valid Profiles	823			802		

Order Statistic	Intercept Altitude					
	20 km			30 km		
	Spread Distance	Date/Time	Figure No.	Spread Distance	Date/Time	Figure No.
Minimum	1048.	920719-2300	277	8244.	910607-1100	254
5th percentile	11157.	920812-2300	282	19497.	921010-2300	291
10th percentile	17444.	920724-2300	278	27379.	921105-1100	294
25th percentile	27112.	910501-0000	250	41475.	920927-1100	288
Median	43032.	910804-1100	260	59036.	920726-0000	279
75th percentile	78685.	910523-2300	252	80818.	910805-1100	261
90th percentile	138698.	921225-1100	299	135739.	921213-1100	298
95th percentile	157926.	911202-1200	272	166431.	921225-1100	299
Maximum	242107.	910126-2300	241	248373.	910126-2300	241
Number of Valid Profiles	675			495		

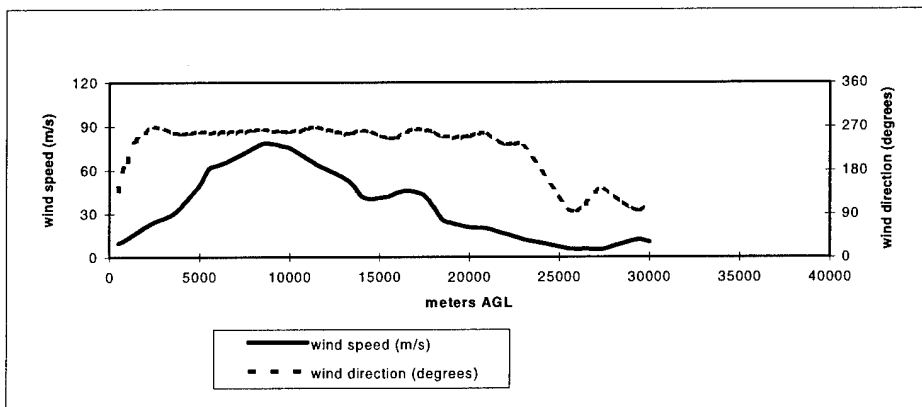
**Table 10. Table of Travel Distances (m), Riyadh, Saudi Arabia**

Order Statistic	Intercept Altitude					
	5 km			10 km		
	Travel Distance	Date/Time	Figure No.	Travel Distance	Date/Time	Figure No.
Minimum	98.	910823-1200	262	80.	920917-2300	287
5th percentile	1186.	921022-1100	293	1871.	910616-1100	255
10th percentile	1650.	910429-1100	249	2729.	920822-1100	284
25th percentile	2585.	910622-2300	256	4399.	921014-1100	292
Median	3812.	920716-2300	276	7396.	910916-2300	264
75th percentile	5337.	921128-1100	296	12822.	910419-1100	247
90th percentile	7449.	910211-2300	243	21532.	911204-1100	274
95th percentile	8705.	921225-2300	300	25045.	910410-1100	245
Maximum	14828.	910305-2300	244	43065.	910126-2300	241
Number of Valid Profiles	823			802		

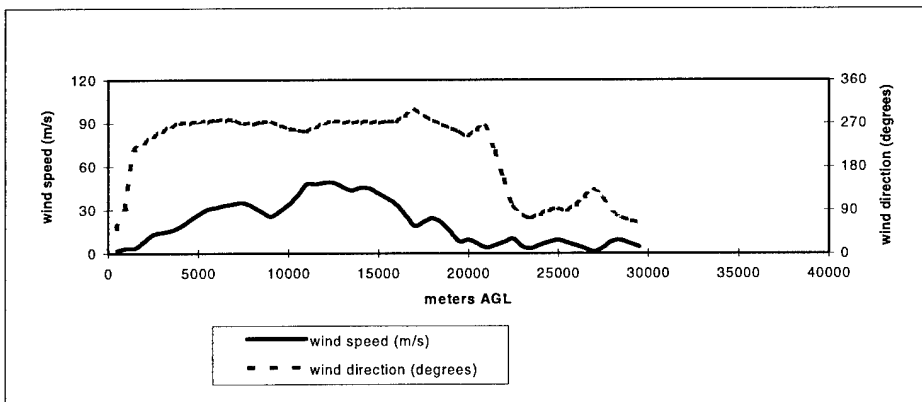
Order Statistic	Intercept Altitude					
	20 km			30 km		
	Travel Distance	Date/Time	Figure No.	Travel Distance	Date/Time	Figure No.
Minimum	858.	910627-1100	258	1166.	910607-1100	254
5th percentile	2937.	910628-1100	259	4644.	920904-2300	286
10th percentile	4447.	910607-1100	254	6245.	910605-2300	253
25th percentile	7348.	910626-1100	257	9029.	911008-2300	267
Median	11847.	920808-1100	281	12672.	920728-1100	280
75th percentile	22382.	910522-1100	251	20011.	911002-2300	265
90th percentile	38819.	921126-2300	295	38172.	911205-2300	275
95th percentile	44628.	921129-2300	297	44491.	910119-2300	240
Maximum	68602.	910126-2300	241	69854.	910126-2300	241
Number of Valid Profiles	675			495		



**Figure 240. Riyadh 910119-2300**



**Figure 241. Riyadh 910126-2300**



**Figure 242. Riyadh 910201-1200**

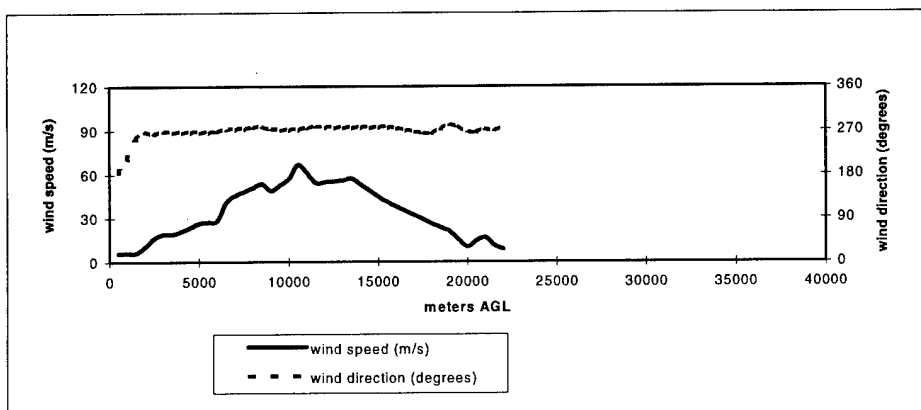


Figure 243. Riyadh 910211-2300

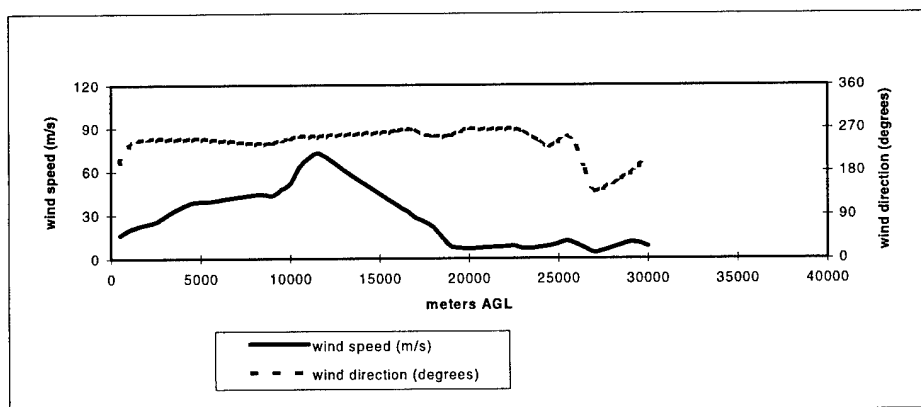


Figure 244. Riyadh 910305-2300

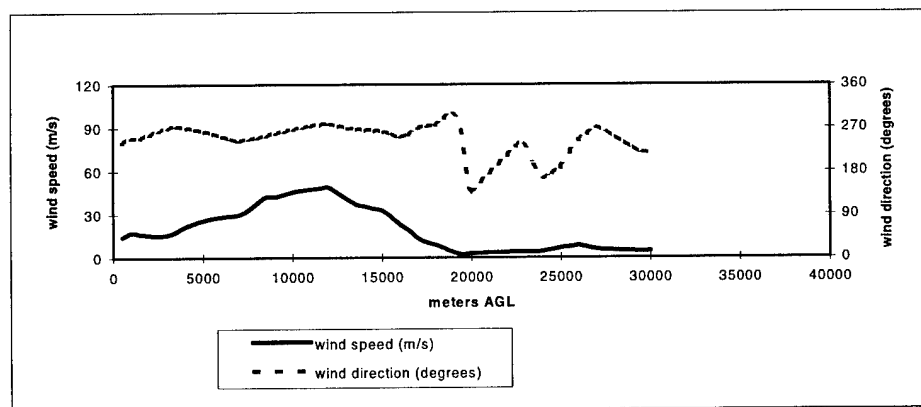
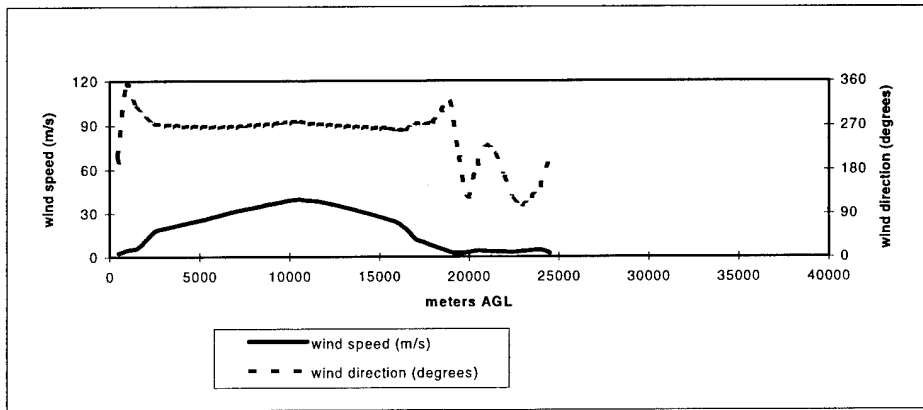
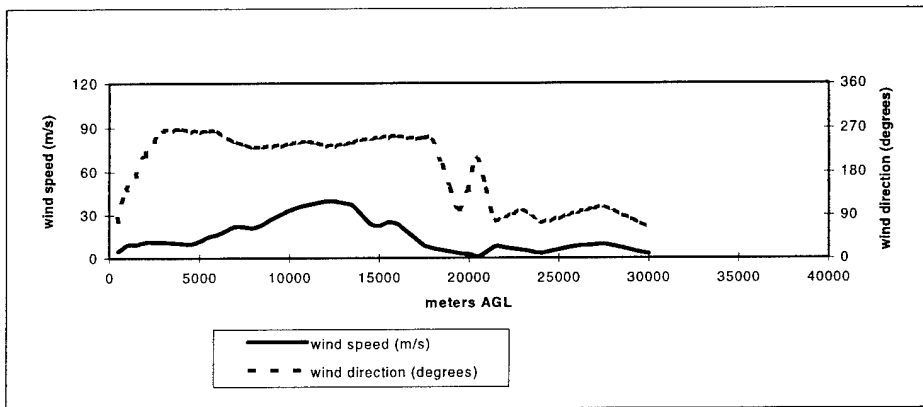


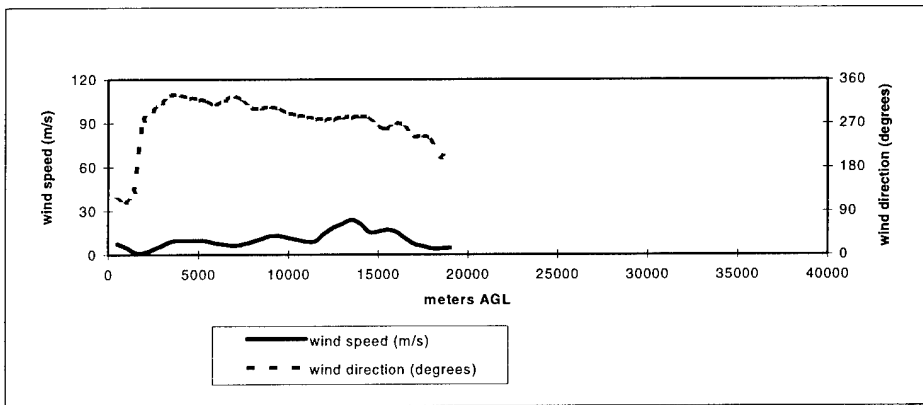
Figure 245. Riyadh 910410-1100



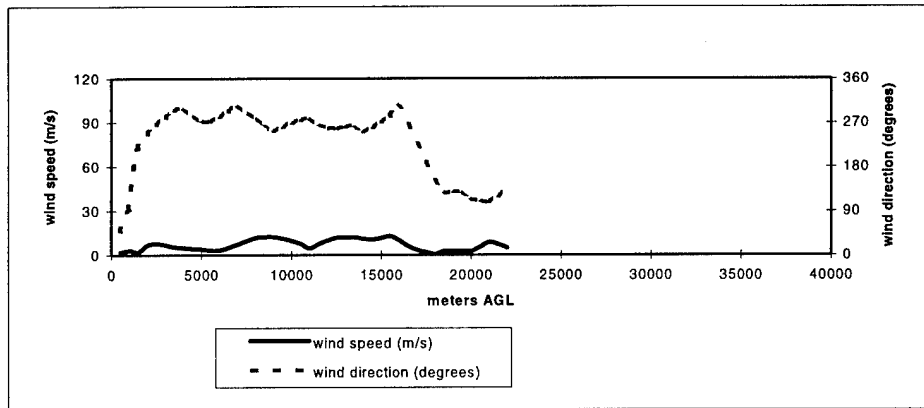
**Figure 246. Riyadh 910412-1100**



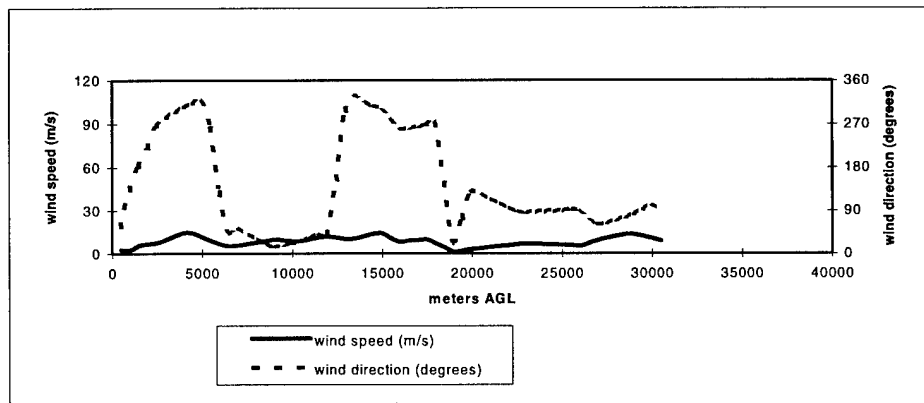
**Figure 247. Riyadh 910419-1100**



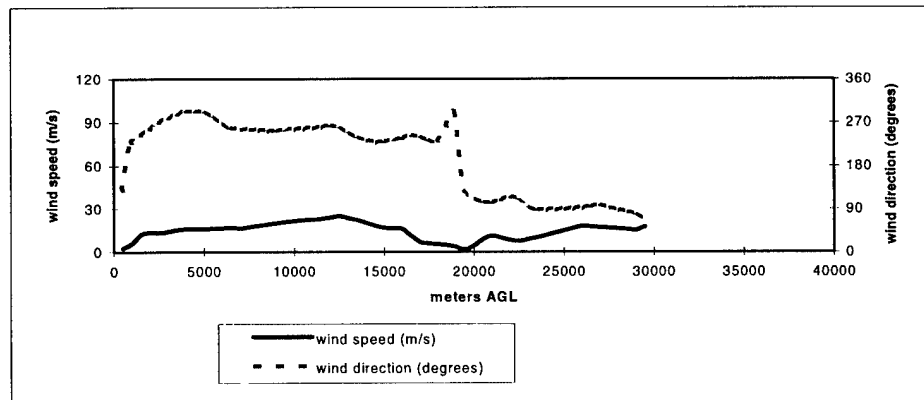
**Figure 248. Riyadh 910424-2300**



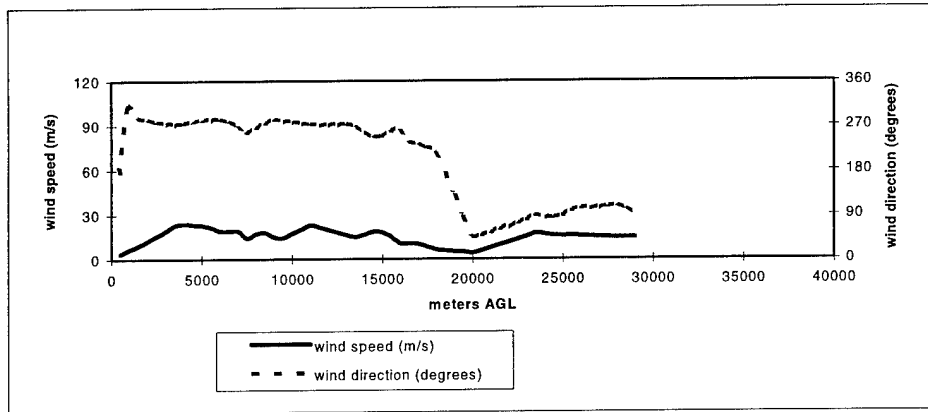
**Figure 249. Riyadh 910429-1100**



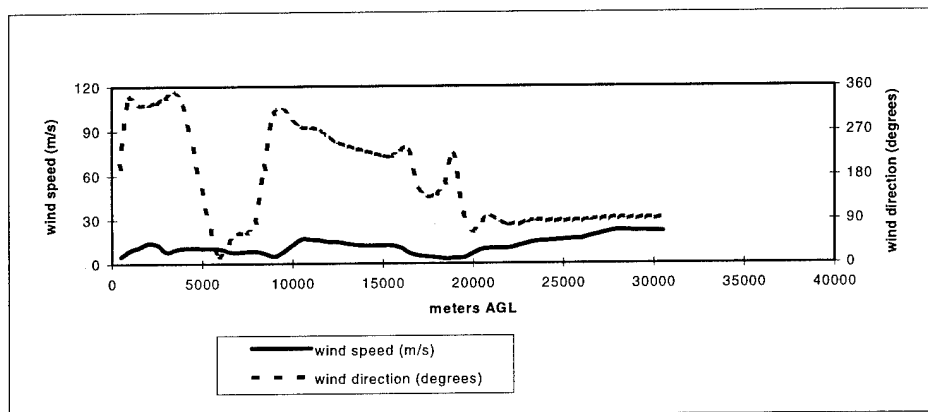
**Figure 250. Riyadh 910501-0000**



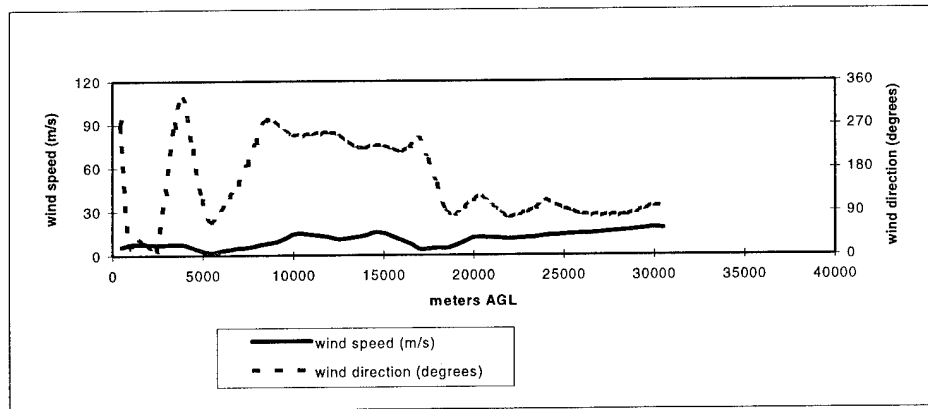
**Figure 251. Riyadh 910522-1100**



**Figure 252. Riyadh 910523-2300**



**Figure 253. Riyadh 910605-2300**



**Figure 254. Riyadh 910607-1100**



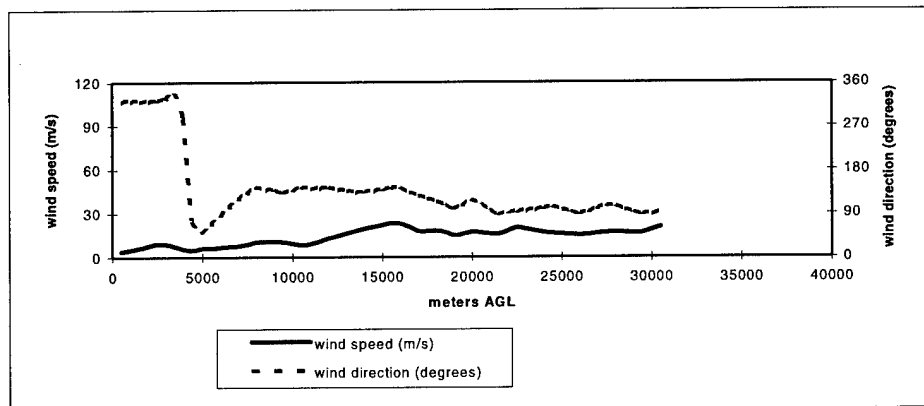


Figure 255. Riyadh 910616-1100

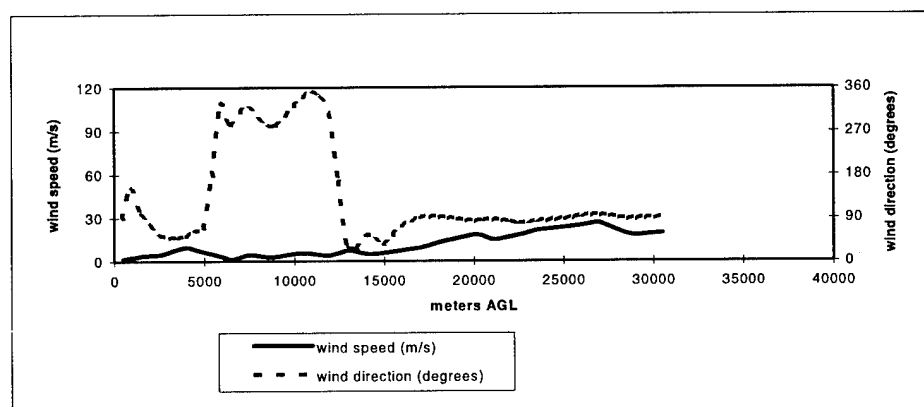


Figure 256. Riyadh 910622-2300

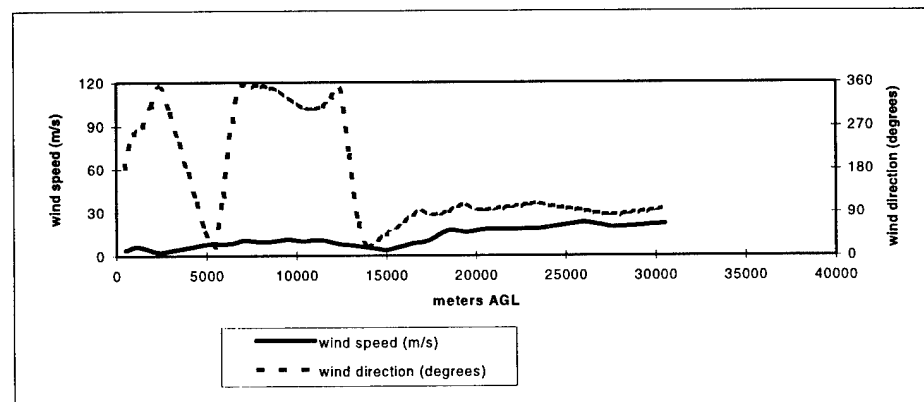


Figure 257. Riyadh 910626-1100

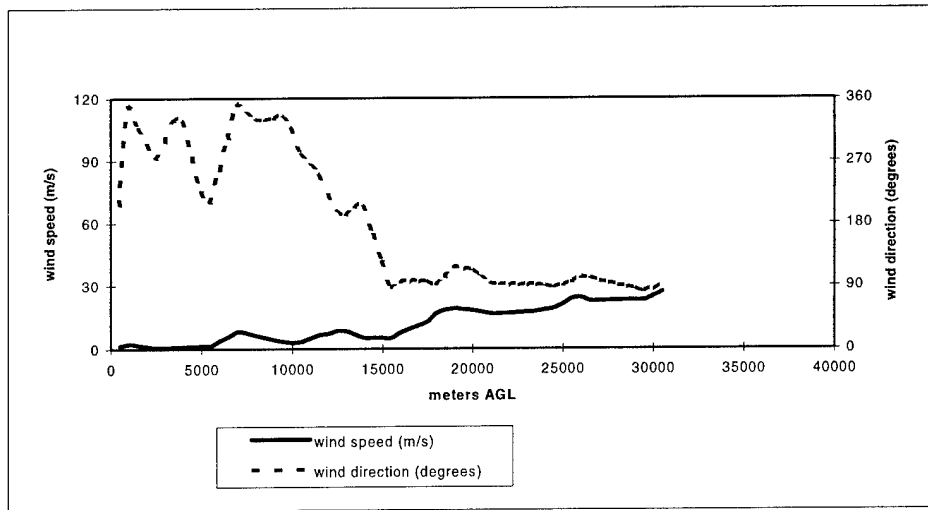


Figure 258. Riyadh 910627-1100

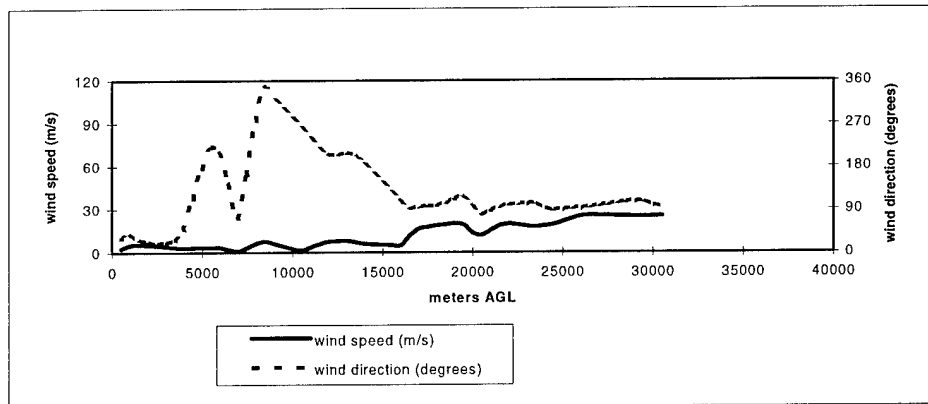


Figure 259. Riyadh 910628-1100

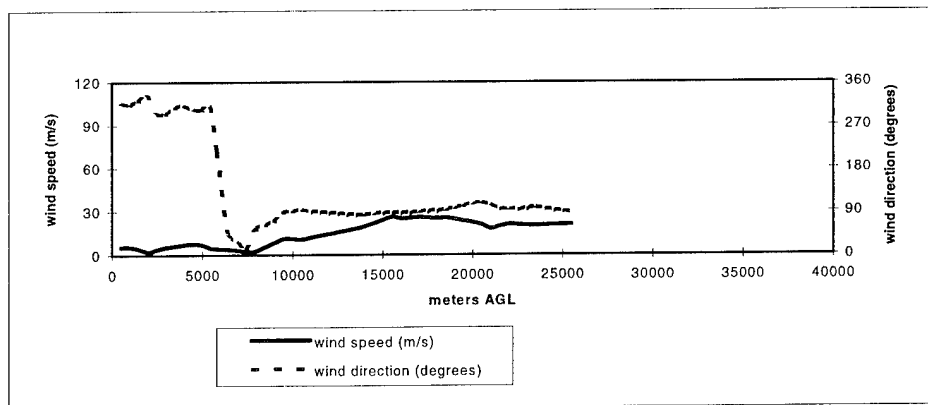


Figure 260. Riyadh 910804-1100

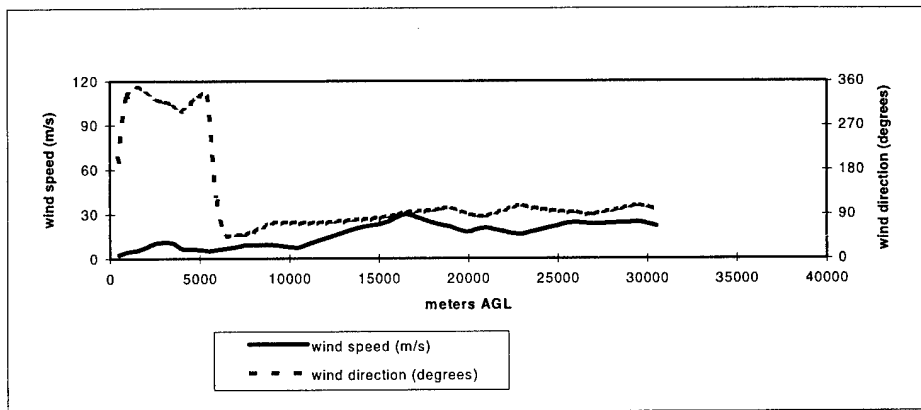


Figure 261. Riyadh 910805-1100

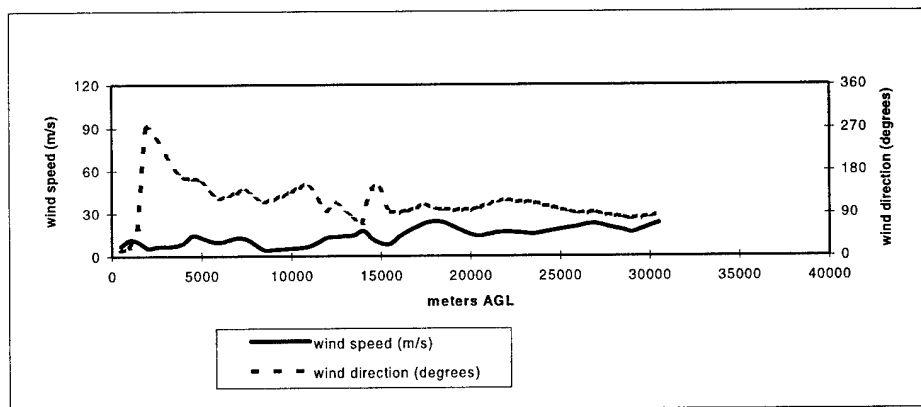


Figure 262. Riyadh 910823-1200

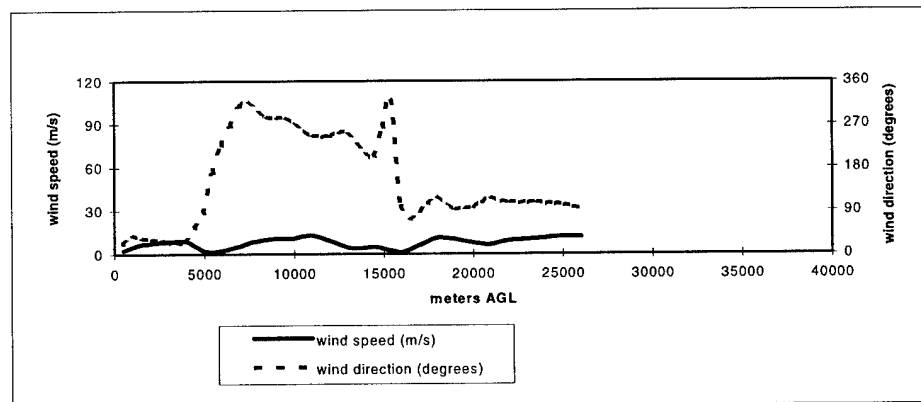


Figure 263. Riyadh 910916-1100

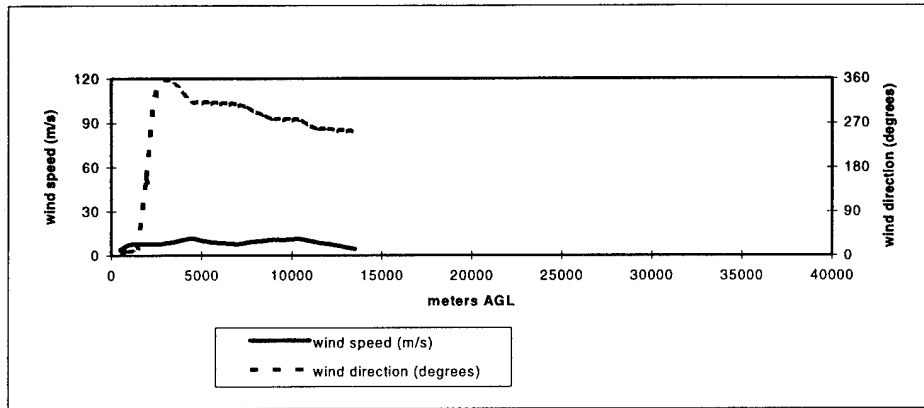


Figure 264. Riyadh 910916-2300

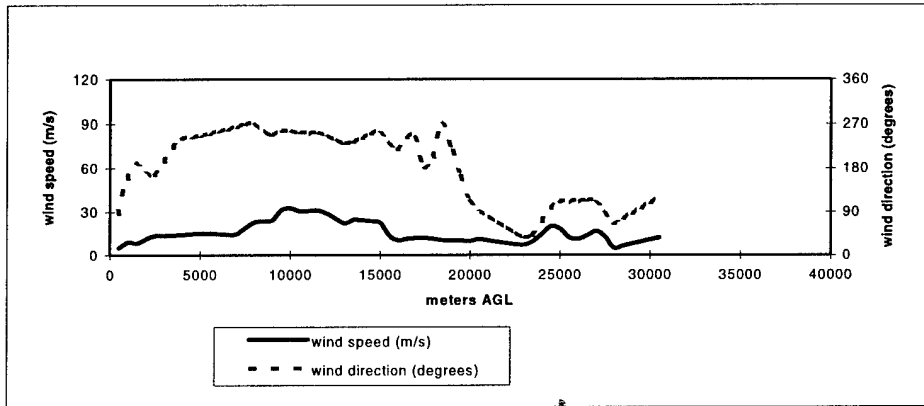


Figure 265. Riyadh 911002-2300

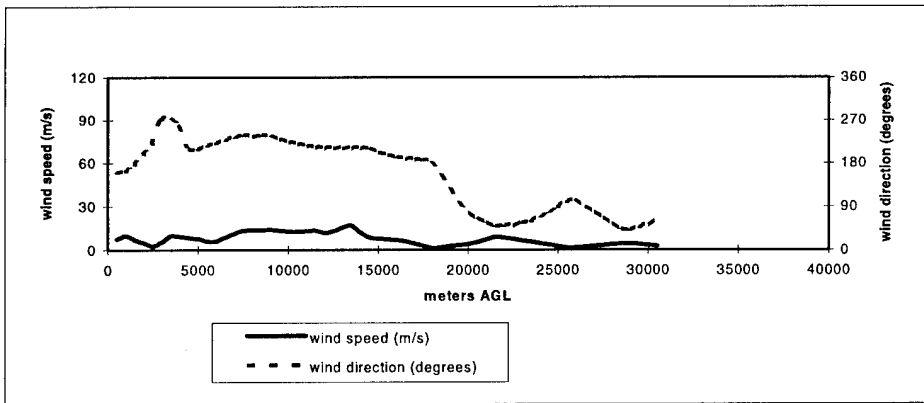


Figure 266. Riyadh 911004-2300

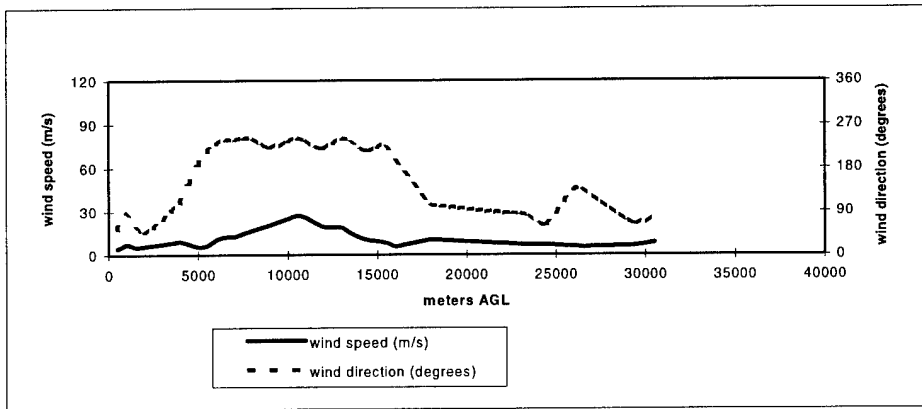


Figure 267. Riyadh 911008-2300

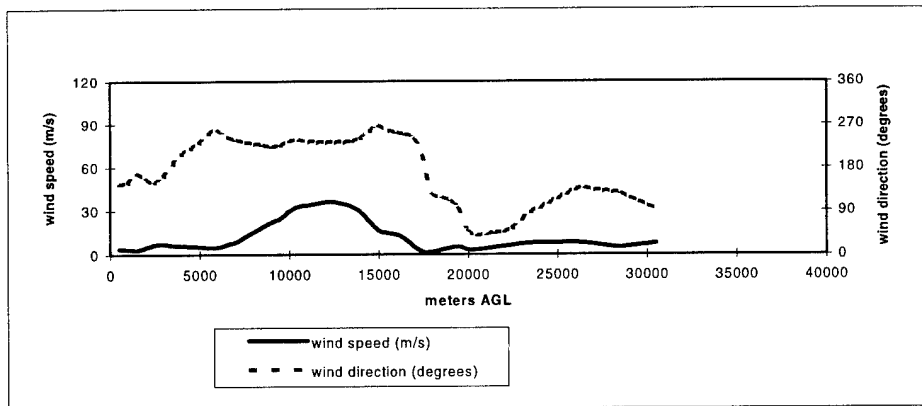


Figure 268. Riyadh 911020-2300

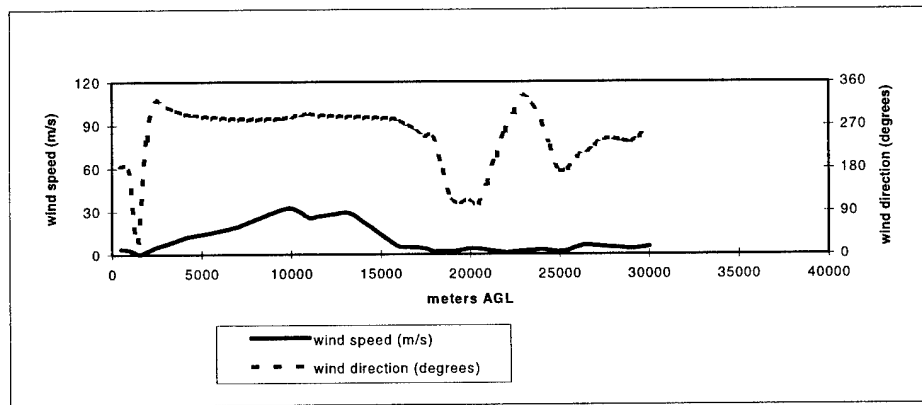
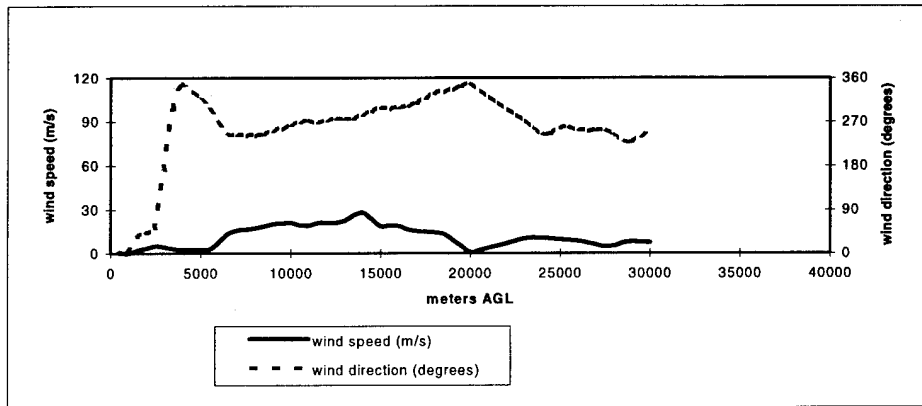
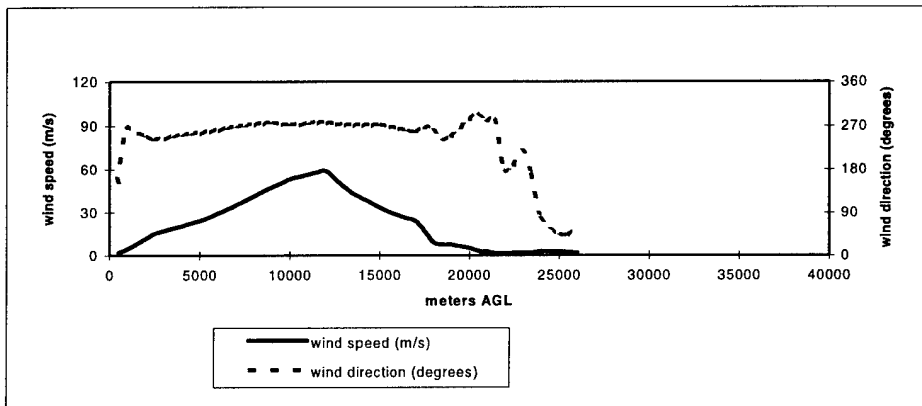


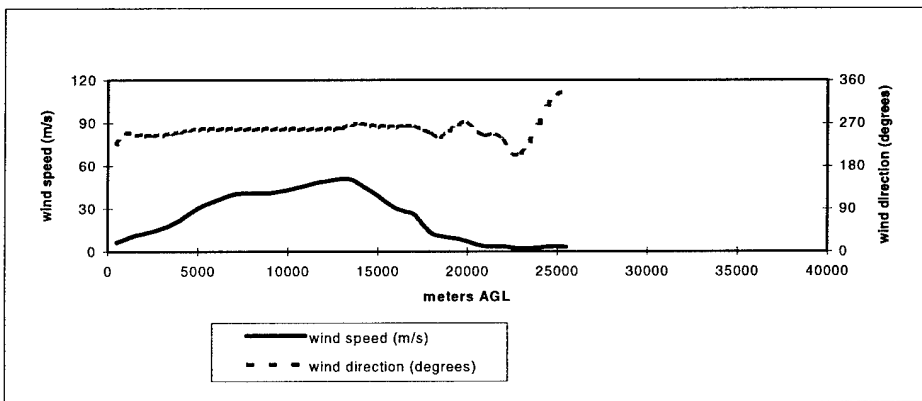
Figure 269. Riyadh 911111-2300



**Figure 270. Riyadh 91122-2300**



**Figure 271. Riyadh 911201-1100**



**Figure 272. Riyadh 911202-1200**

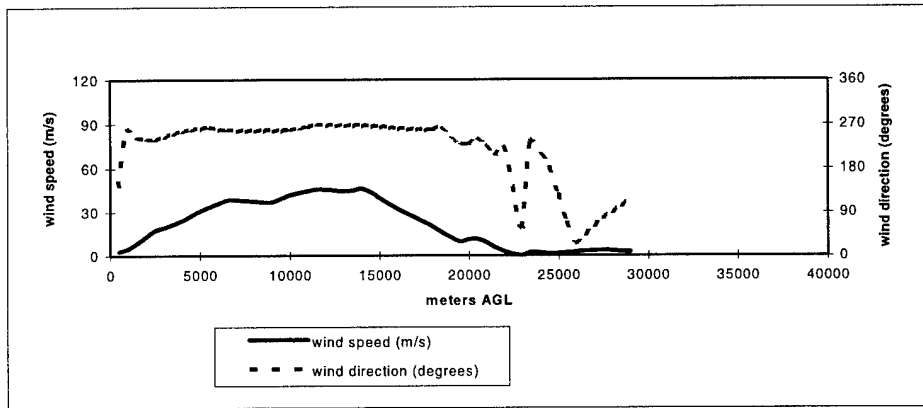


Figure 273. Riyadh 911203-1200

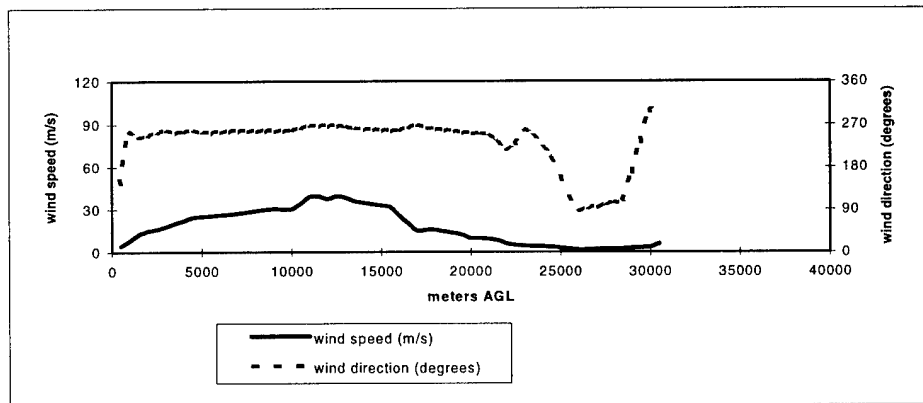


Figure 274. Riyadh 911204-1100

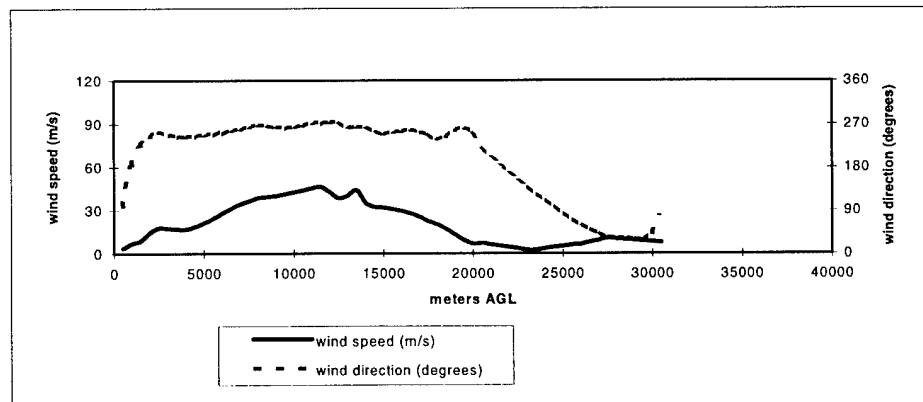
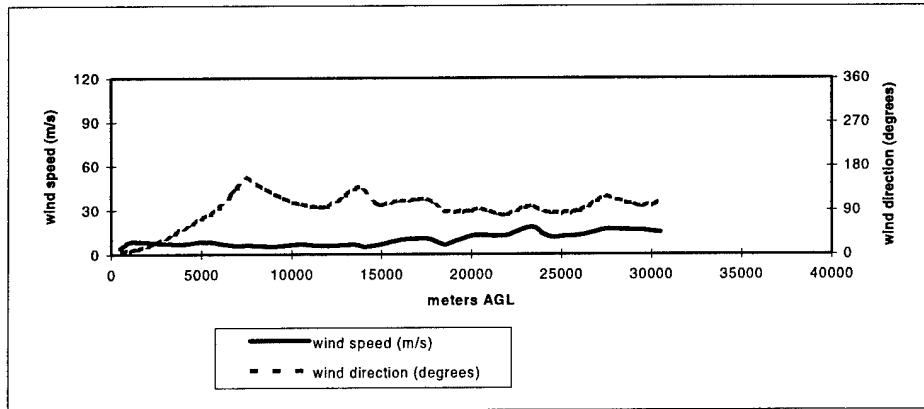
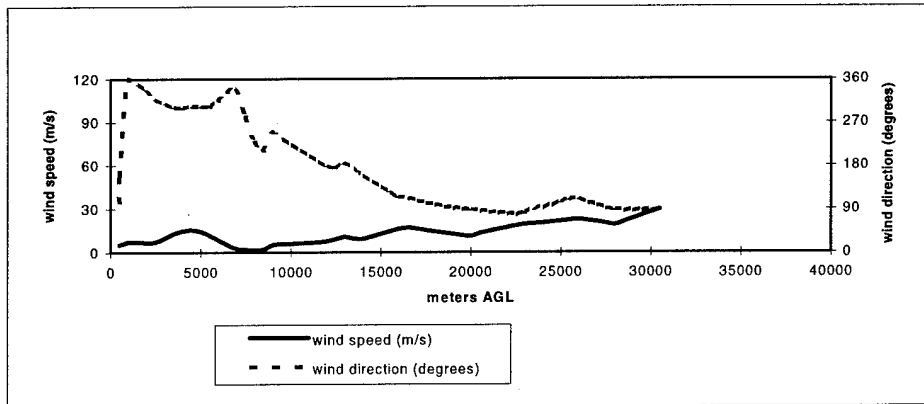


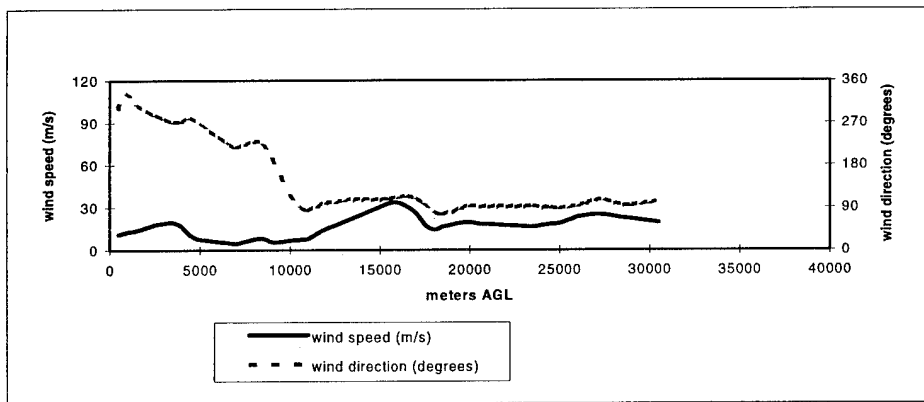
Figure 275. Riyadh 911205-2300



**Figure 276. Riyadh 920716-2300**



**Figure 277. Riyadh 920719-2300**



**Figure 278. Riyadh 920724-2300**



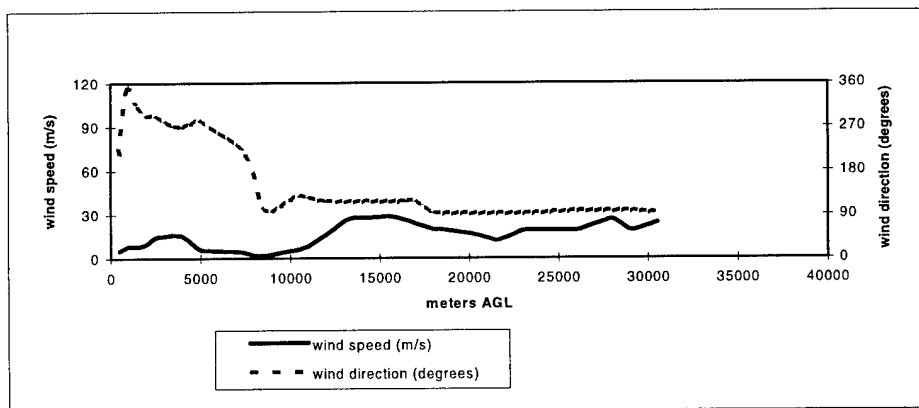


Figure 279. Riyadh 920726-0000

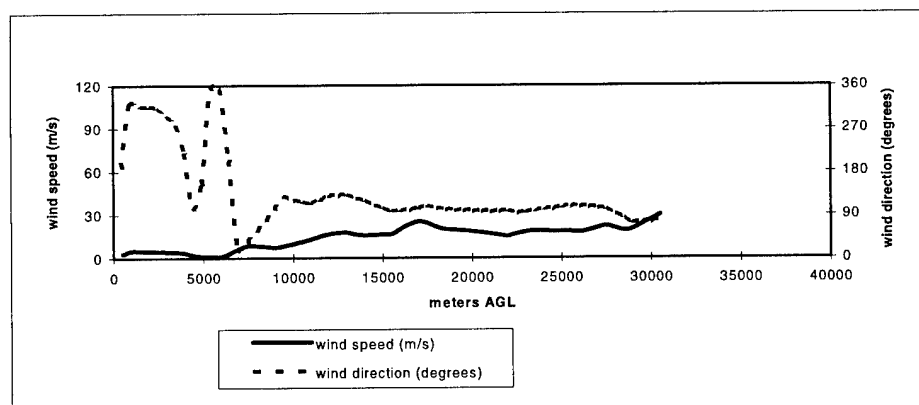


Figure 280. Riyadh 920728-1100

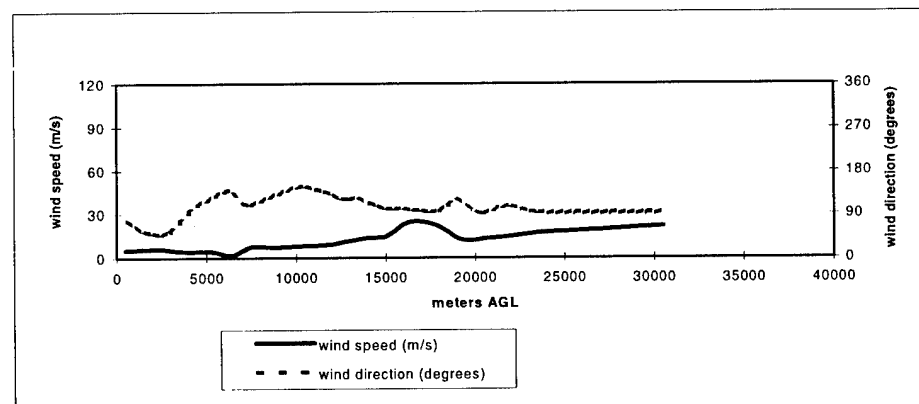


Figure 281. Riyadh 920808-1100

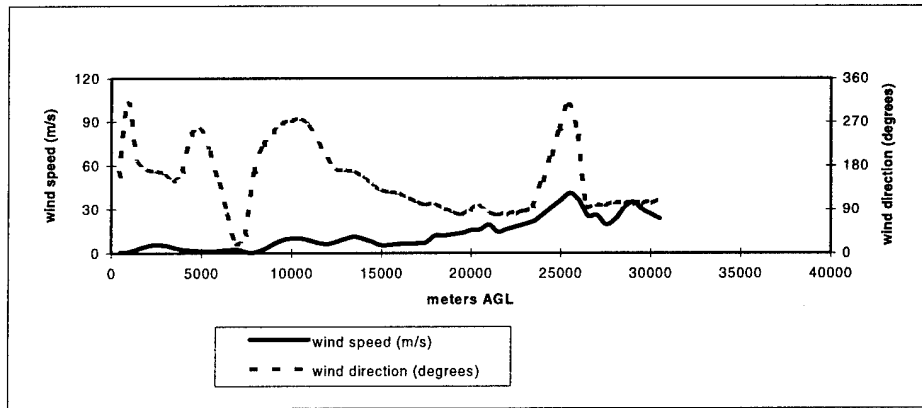


Figure 282. Riyadh 920812-2300

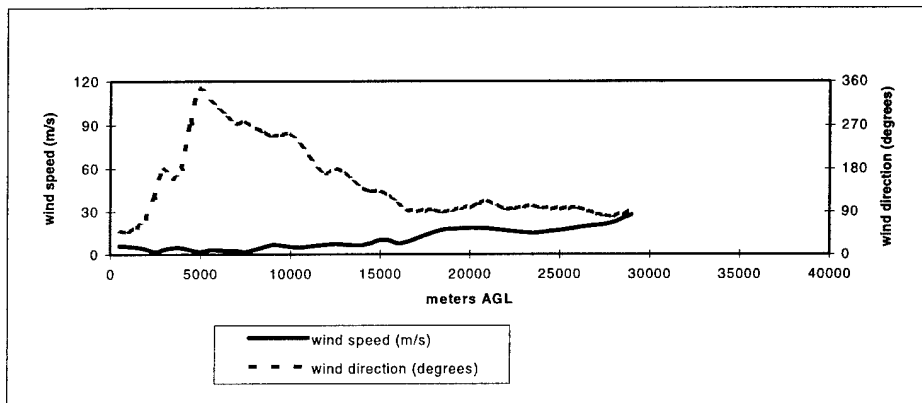


Figure 283. Riyadh 920813-1100

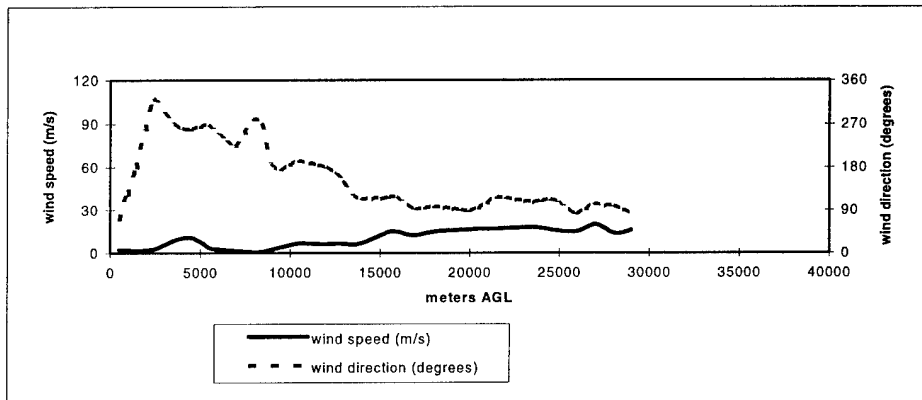


Figure 284. Riyadh 920822-1100

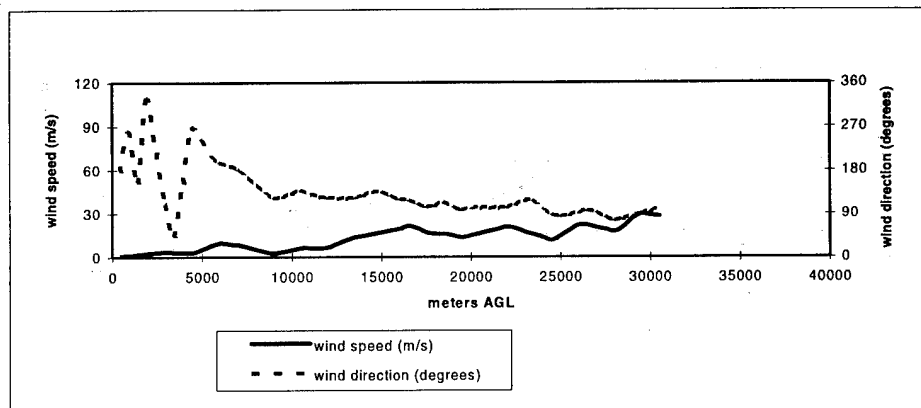


Figure 285. Riyadh 920823-1100

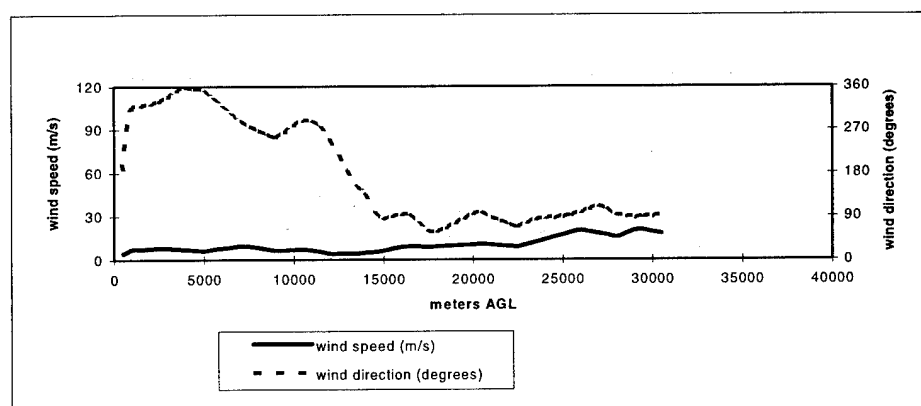


Figure 286. Riyadh 920904-2300

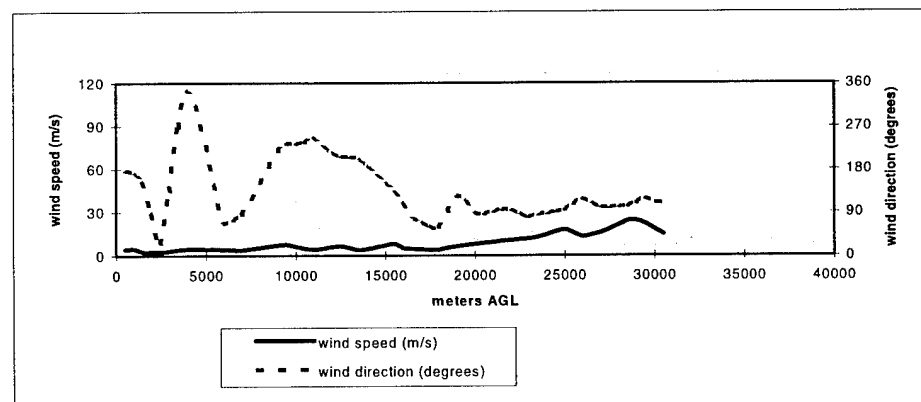
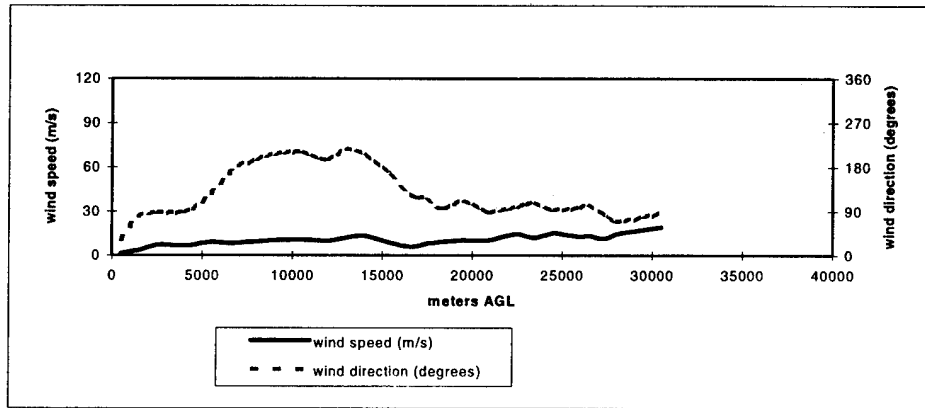
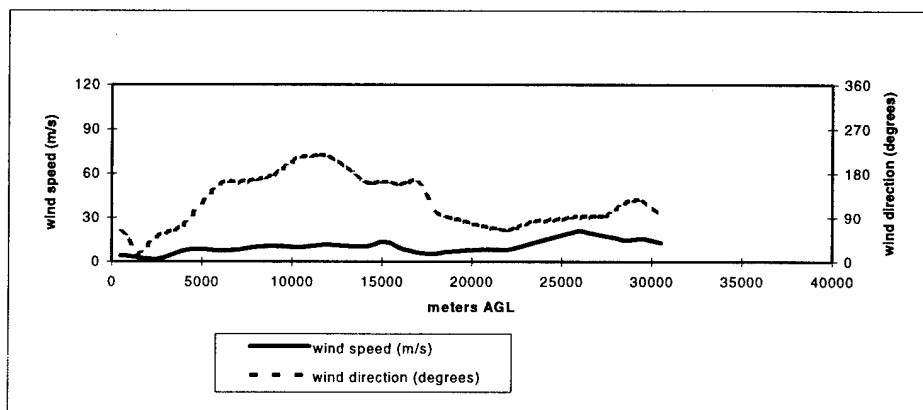


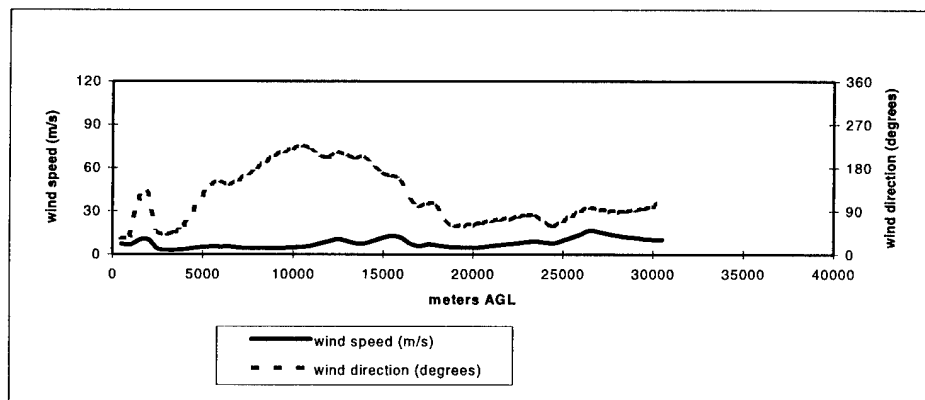
Figure 287. Riyadh 920917-2300



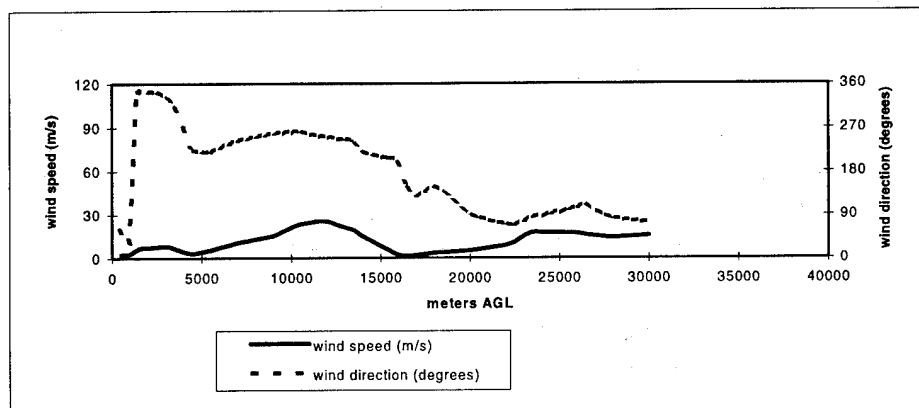
**Figure 288. Riyadh 920927-1100**



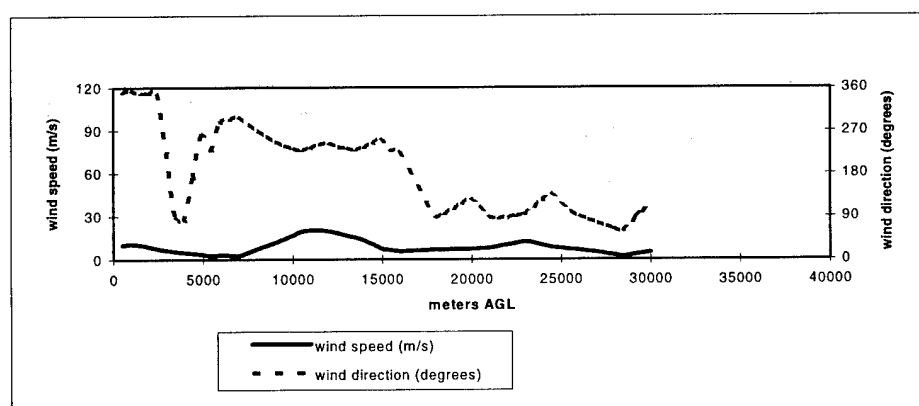
**Figure 289. Riyadh 920927-2300**



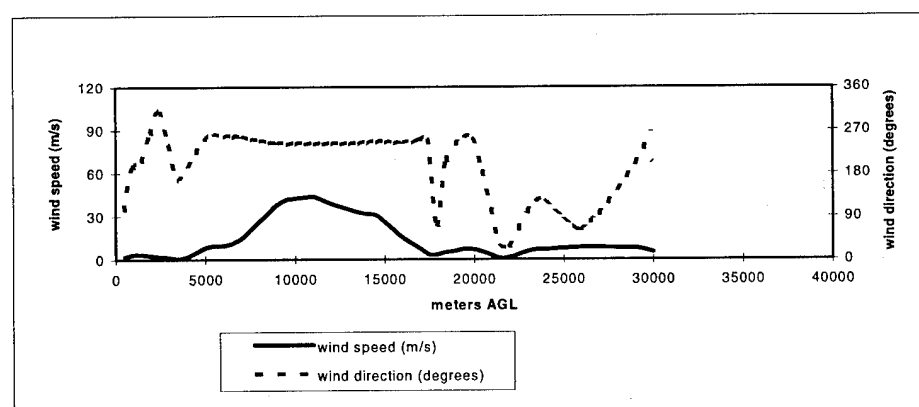
**Figure 290. Riyadh 920929-2300**



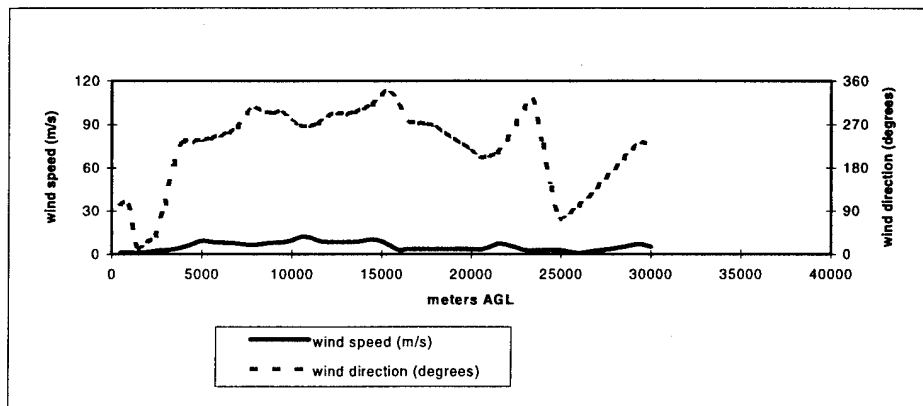
**Figure 291. Riyadh 921010-2300**



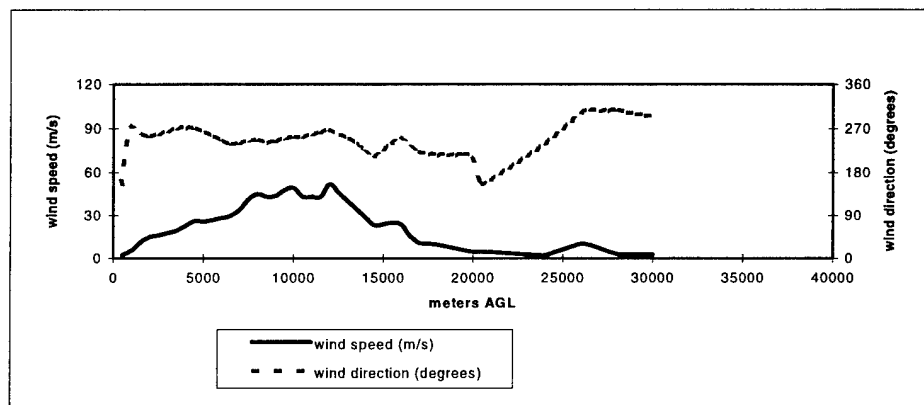
**Figure 292. Riyadh 921014-1100**



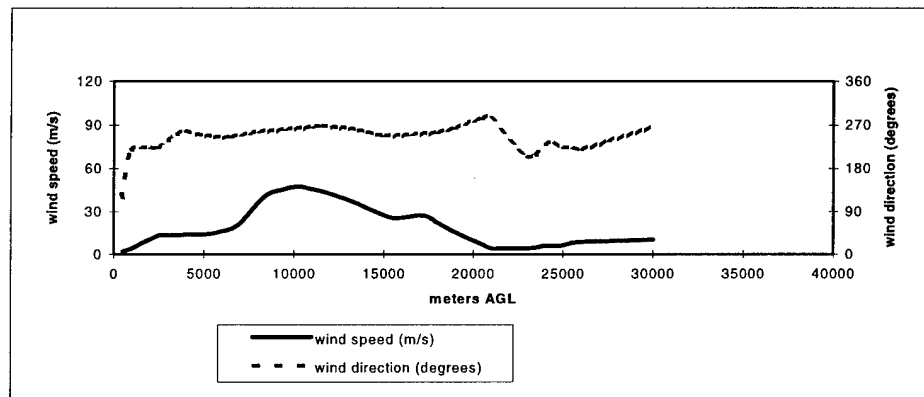
**Figure 293. Riyadh 921022-1100**



**Figure 294. Riyadh 921105-1100**



**Figure 295. Riyadh 921126-2300**



**Figure 296. Riyadh 921128-1100**

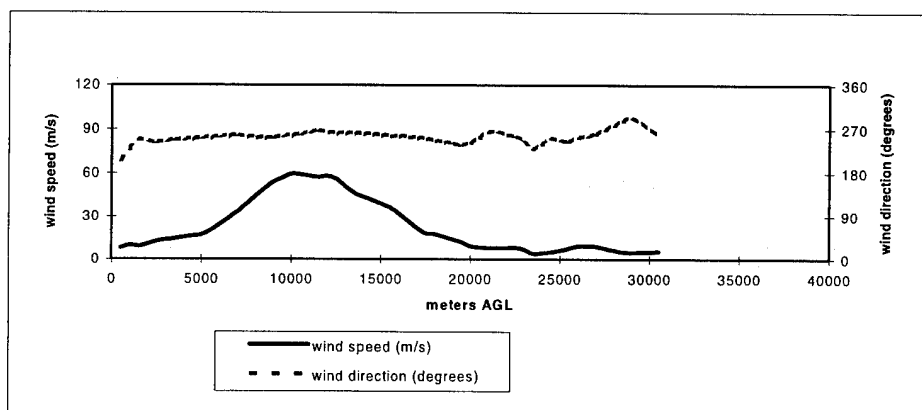


Figure 297. Riyadh 921129-2300

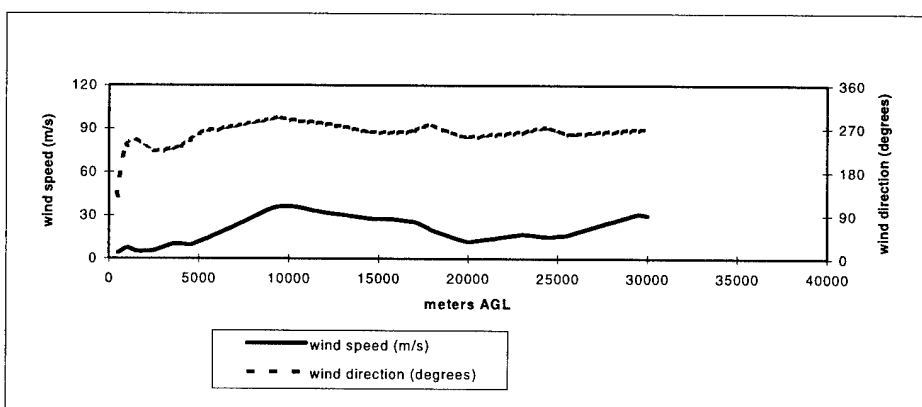


Figure 298. Riyadh 921213-1100

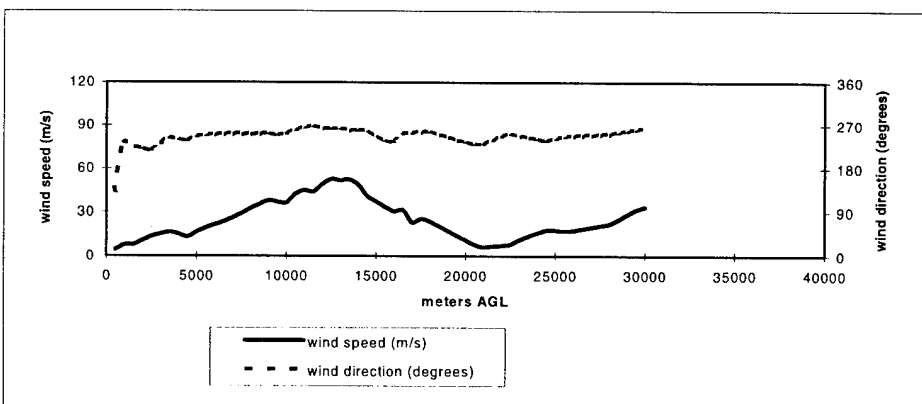


Figure 299. Riyadh 921225-1100

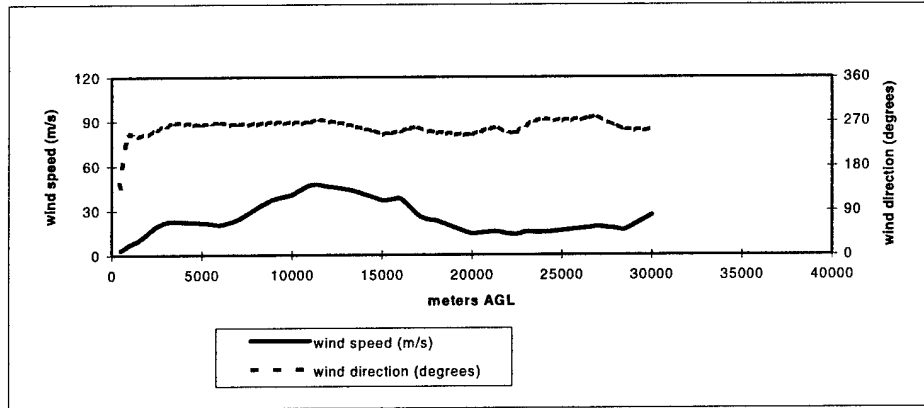


Figure 300. Riyadh 921225-2300



## 6.6 Pokang, South Korea

**Table 11. Table of Spread Distances (m), Pokang, South Korea**

Order Statistic	Intercept Altitude					
	5 km			10 km		
	Spread Distance	Date/Time	Figure No.	Spread Distance	Date/Time	Figure No.
Minimum	553.	921130-0000	358	1815.	910820-1200	323
5th percentile	3977.	920707-0000	343	19176.	911009-1200	328
10th percentile	5883.	920921-1200	352	25346.	910809-0000	319
25th percentile	9890.	910426-0000	310	36720.	910728-1800	318
Median	16291.	920727-1200	345	53984.	910701-1200	316
75th percentile	23155.	911016-1200	330	75138.	911021-0000	331
90th percentile	30731.	910220-1200	307	95239.	910920-1200	327
95th percentile	35513.	921103-0000	355	106039.	911124-1200	335
Maximum	57100.	921223-0000	361	163613.	921223-0000	361
Number of Valid Profiles	1283			1279		

Order Statistic	Intercept Altitude					
	20 km			30 km		
	Spread Distance	Date/Time	Figure No.	Spread Distance	Date/Time	Figure No.
Minimum	9149.	910825-0000	324	4442.	920727-0000	344
5th percentile	46267.	920805-1200	348	36934.	910820-0000	322
10th percentile	57851.	920809-0000	349	47540.	910522-1200	314
25th percentile	89691.	920623-0000	341	85451.	920914-1200	351
Median	124980.	920302-0000	336	122260.	921015-0000	353
75th percentile	164900.	911121-0000	333	168387.	920309-0000	337
90th percentile	196668.	921210-1200	359	208623.	921217-1200	360
95th percentile	214867.	921125-0000	357	235474.	910501-0000	312
Maximum	305658.	910219-0000	306	315637.	910219-0000	306
Number of Valid Profiles	1031			671		

**Table 12. Table of Travel Distances (m), Pokang, South Korea**

Order Statistic	Intercept Altitude					
	5 km			10 km		
	Travel Distance	Date/Time	Figure No.	Travel Distance	Date/Time	Figure No.
Minimum	168.	921130-0000	358	660.	910817-1200	320
5th percentile	1330.	910530-0000	315	5960.	910411-1200	308
10th percentile	2020.	920910-0000	350	7973.	910809-0000	319
25th percentile	3366.	910903-1200	326	11813.	910826-1200	325
Median	5568.	910118-1200	301	17112.	920605-1200	340
75th percentile	7942.	920522-0000	339	23871.	921110-1200	356
90th percentile	10470.	920502-0000	338	30222.	921029-1200	354
95th percentile	12219.	910124-1200	303	33457.	910122-1200	302
Maximum	19414.	921223-0000	361	51908.	921223-0000	361
Number of Valid Profiles	1283			1279		

Order Statistic	Intercept Altitude					
	20 km			30 km		
	Travel Distance	Date/Time	Figure No.	Travel Distance	Date/Time	Figure No.
Minimum	2827.	910825-0000	324	1310.	910825-0000	324
5th percentile	12723.	920802-0000	347	11706.	910819-0000	321
10th percentile	16454.	911010-1200	329	15522.	920801-0000	346
25th percentile	25322.	910721-0000	317	24525.	910519-1200	313
Median	34846.	910216-1200	305	34425.	920701-0000	342
75th percentile	46043.	910207-0000	304	46144.	910426-1200	311
90th percentile	54936.	921210-1200	359	55968.	910415-0000	309
95th percentile	60221.	911124-0000	334	63844.	911027-0000	332
Maximum	84930.	910219-0000	306	86544.	910219-0000	306
Number of Valid Profiles	1031			671		

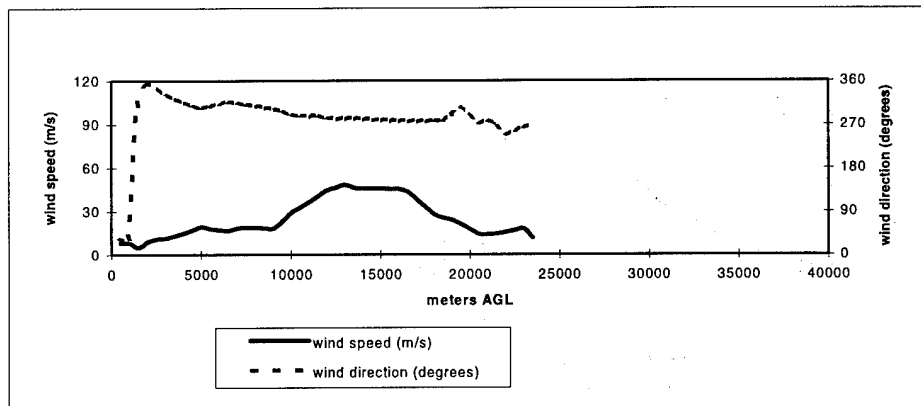


Figure 301. Pokang 910118-1200

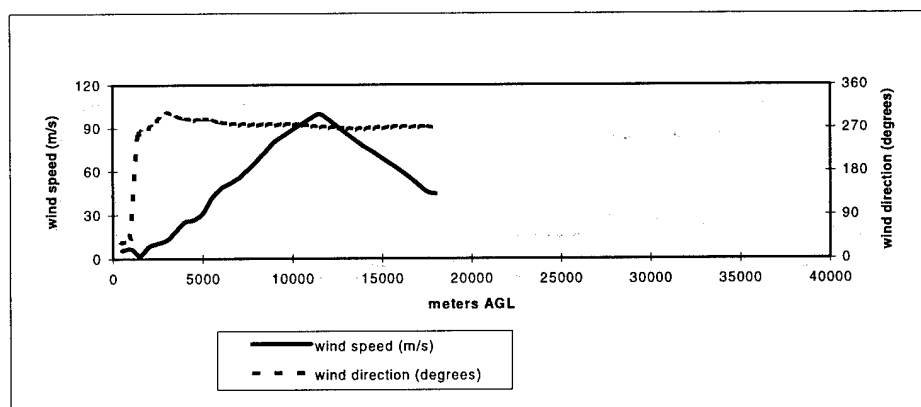


Figure 302. Pokang 910122-1200

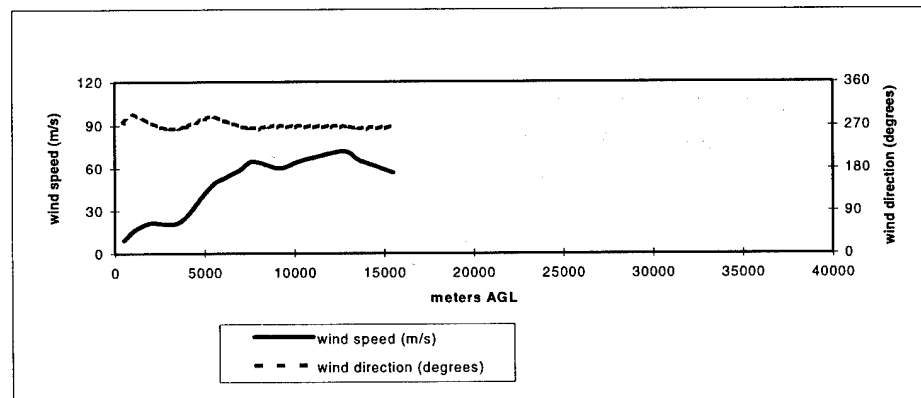
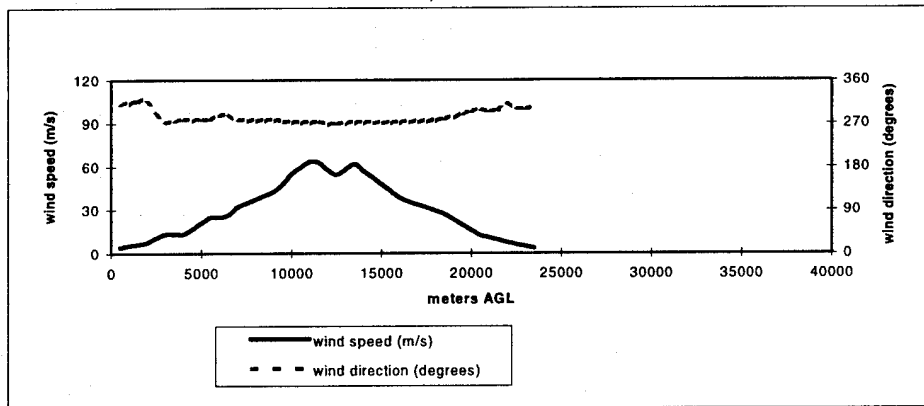
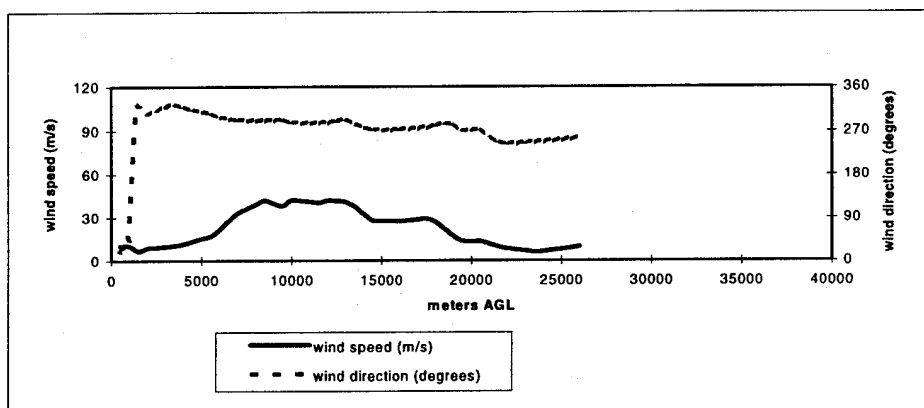


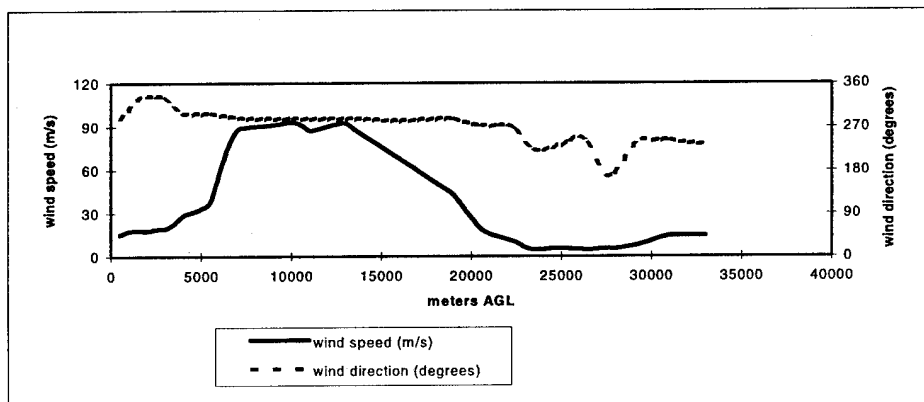
Figure 303. Pokang 910124-1200



**Figure 304. Pokang 910207-0000**



**Figure 305. Pokang 910216-1200**



**Figure 306. Pokang 910219-0000**

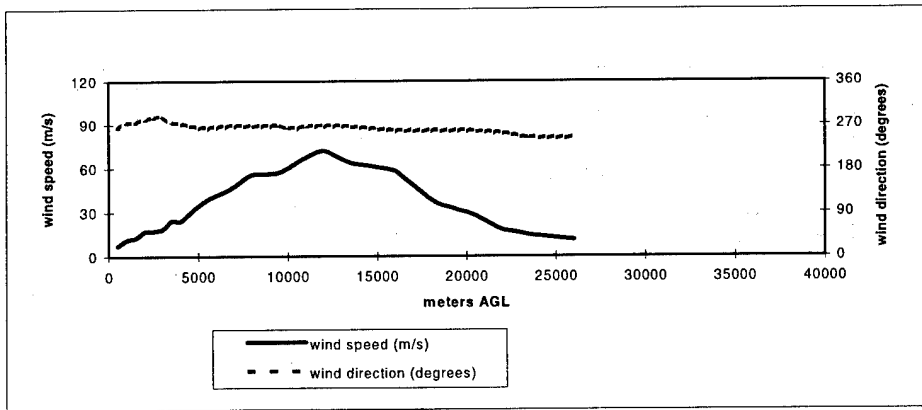


Figure 307. Pokang 910220-1200

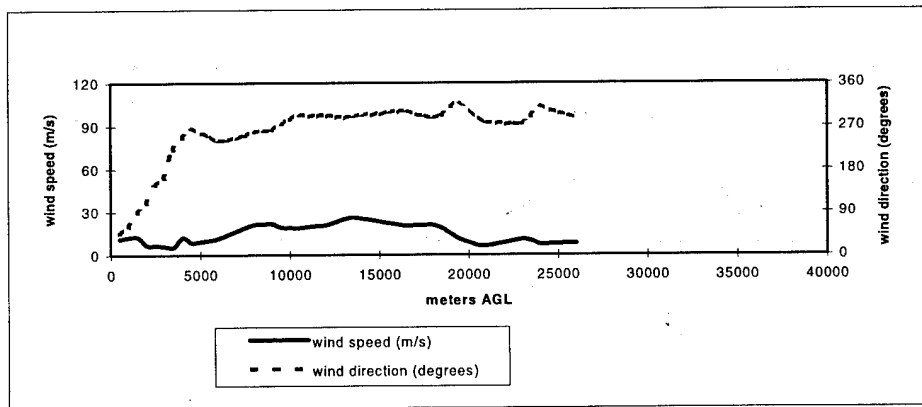


Figure 308. Pokang 910411-1200

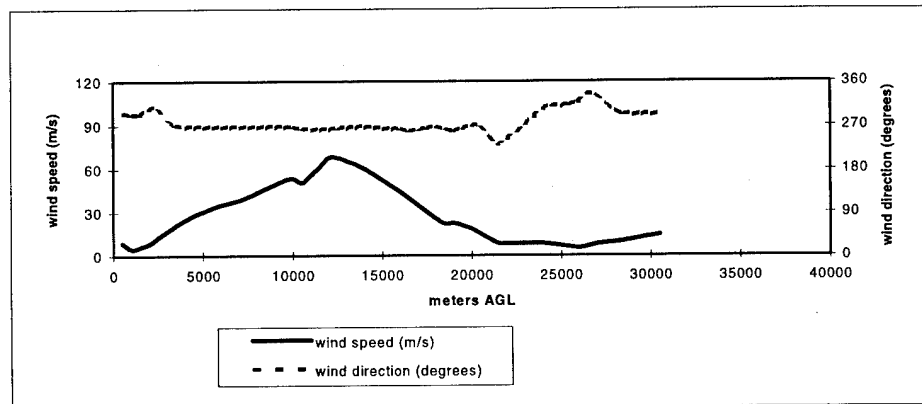
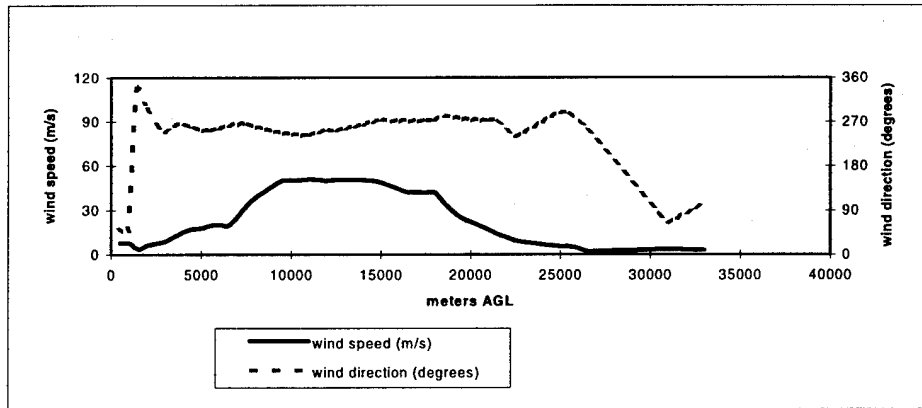
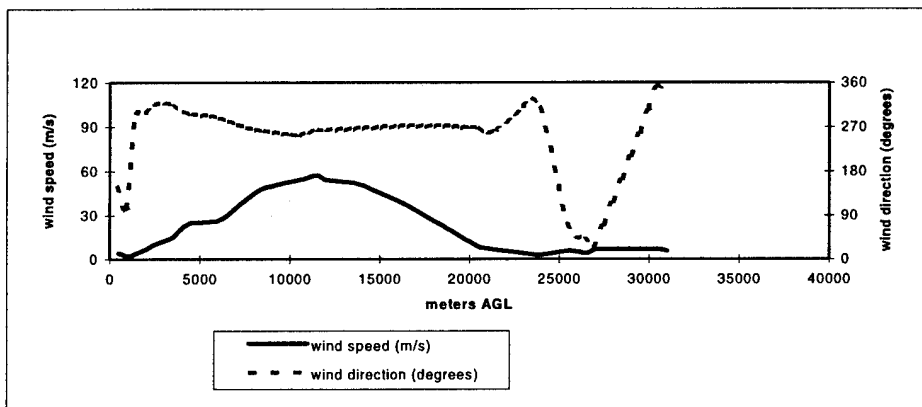


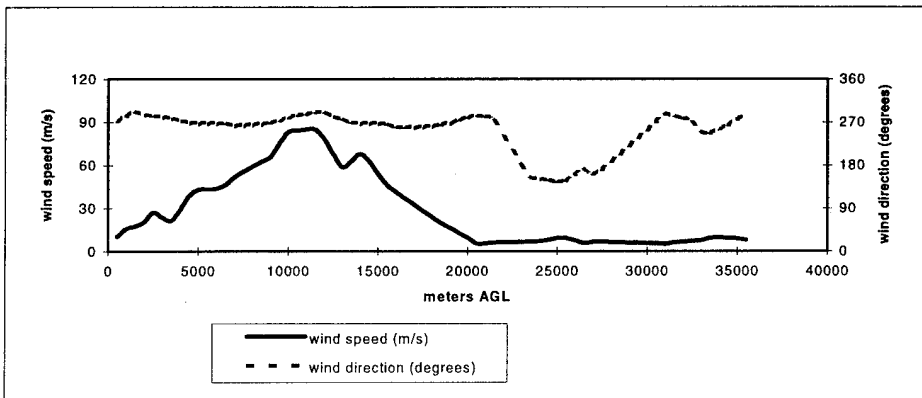
Figure 309. Pokang 910415-0000



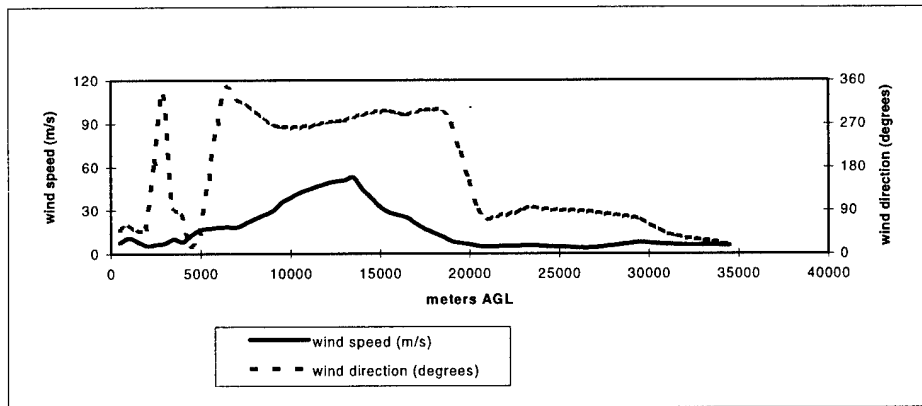
**Figure 310. Pokang 910426-0000**



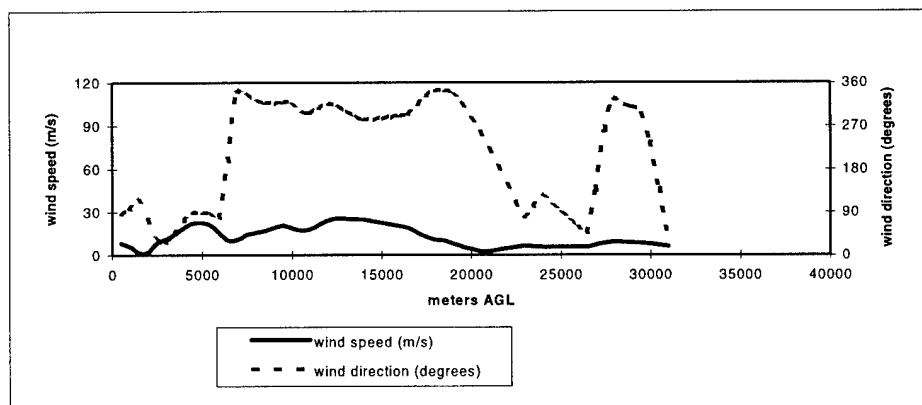
**Figure 311. Pokang 910426-1200**



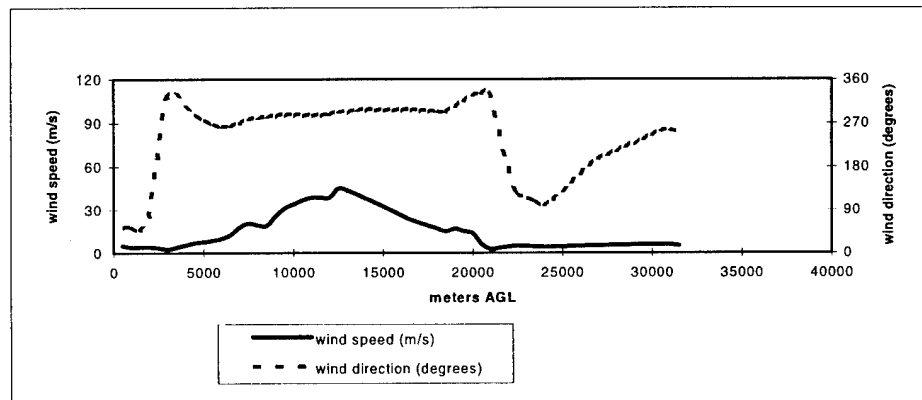
**Figure 312. Pokang 910501-0000**



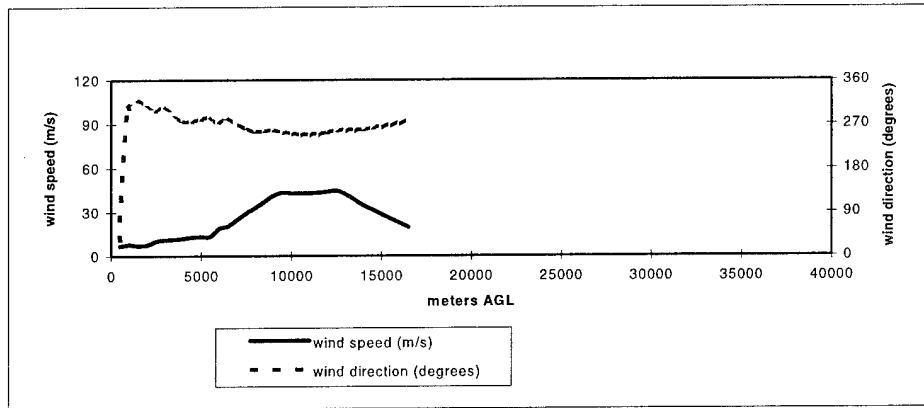
**Figure 313. Pokang 910519-1200**



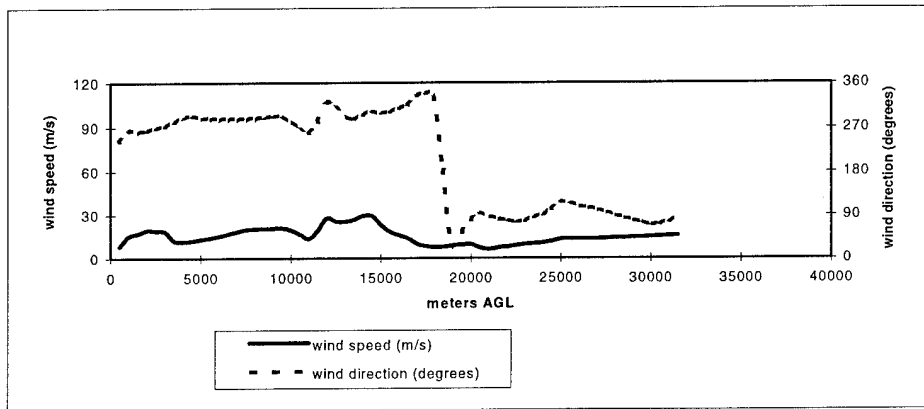
**Figure 314. Pokang 910522-1200**



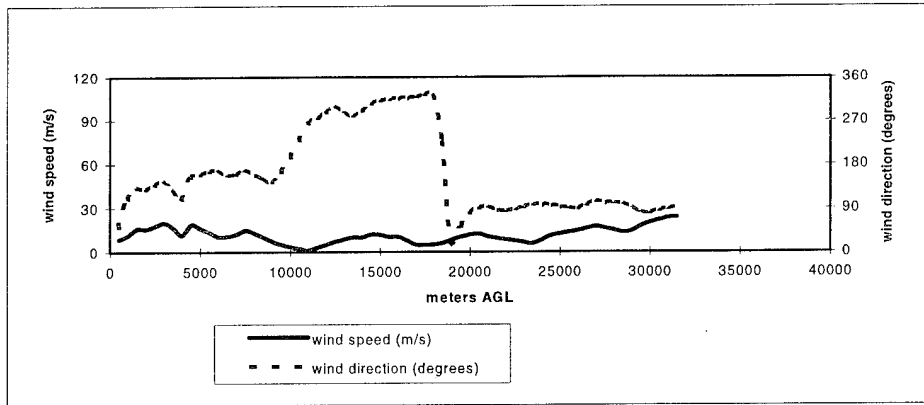
**Figure 315. Pokang 910530-0000**



**Figure 316. Pokang 910701-1200**

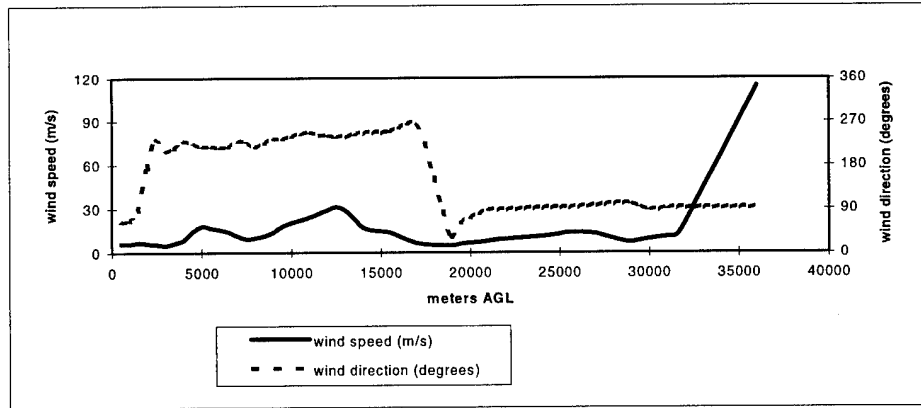


**Figure 317. Pokang 910721-0000**

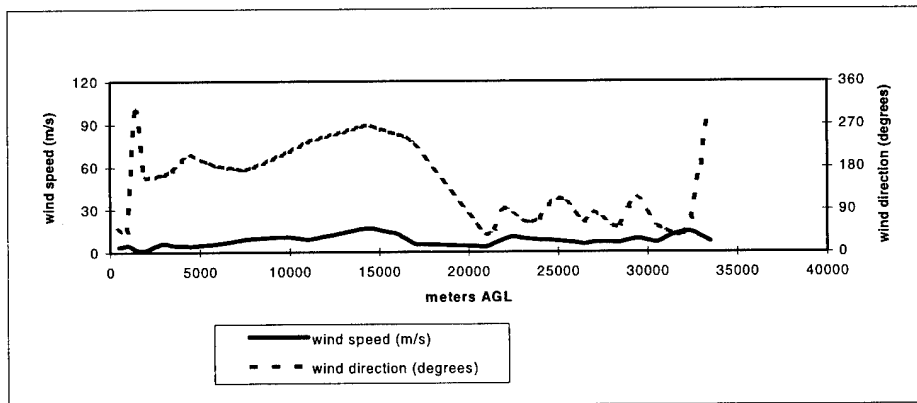


**Figure 318. Pokang 910728-1800**

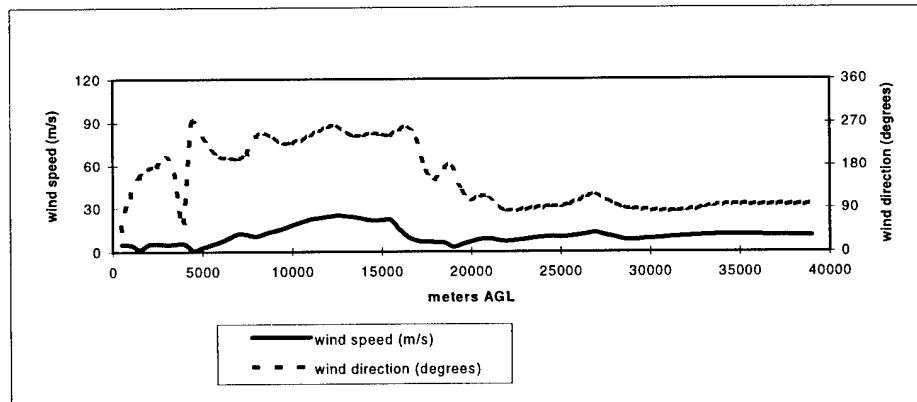




**Figure 319. Pokang 910809-0000**



**Figure 320. Pokang 910817-1200**



**Figure 321. Pokang 910819-0000**

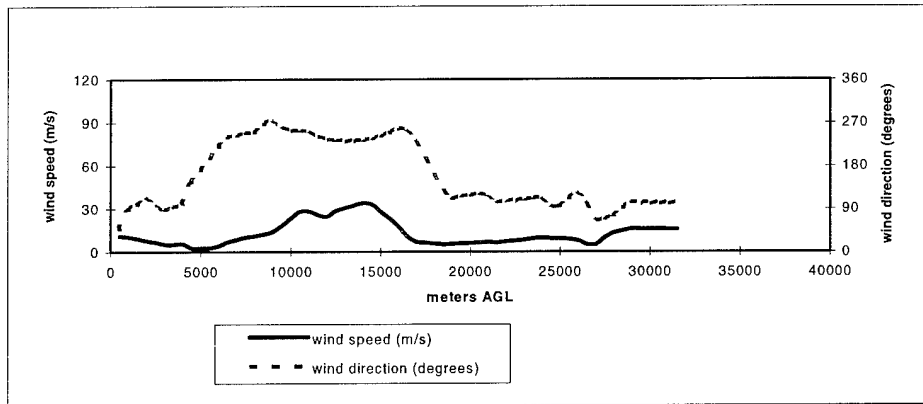


Figure 322. Pokang 910820-0000

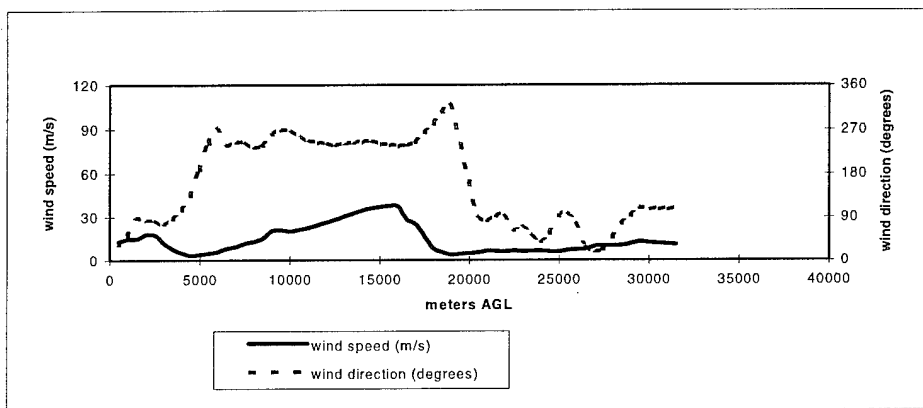


Figure 323. Pokang 910820-1200

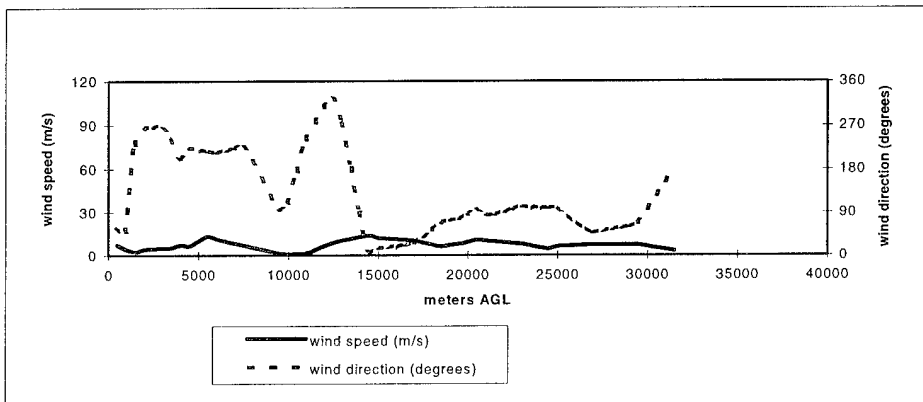


Figure 324. Pokang 910825-0000

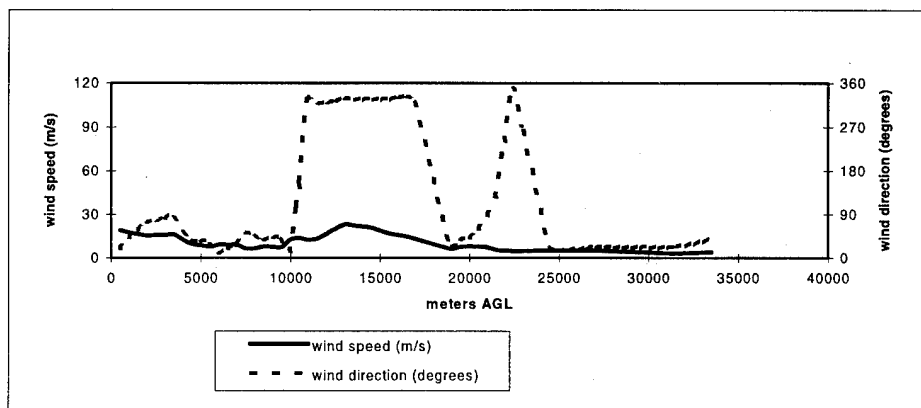


Figure 325. Pokang 910826-1200

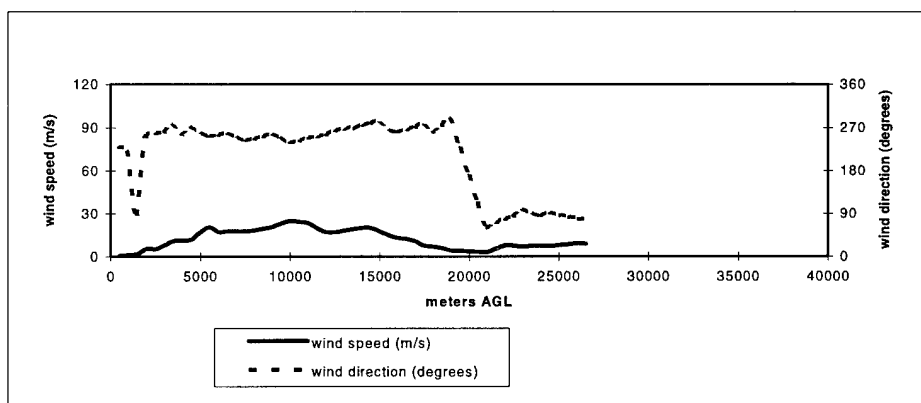


Figure 326. Pokang 910903-1200

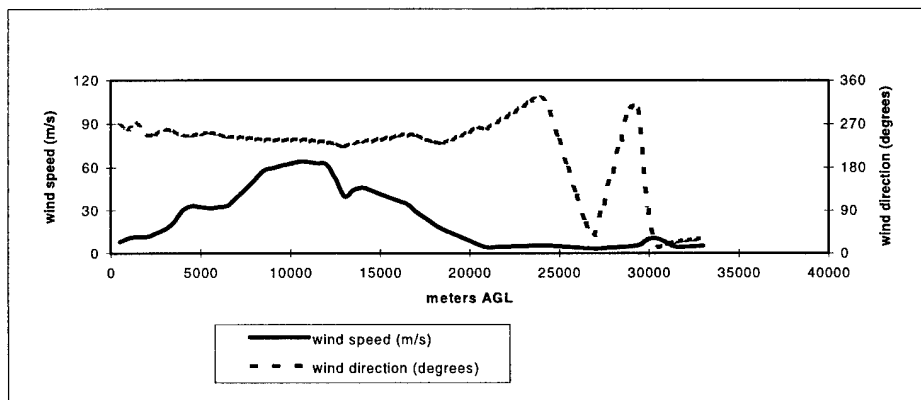
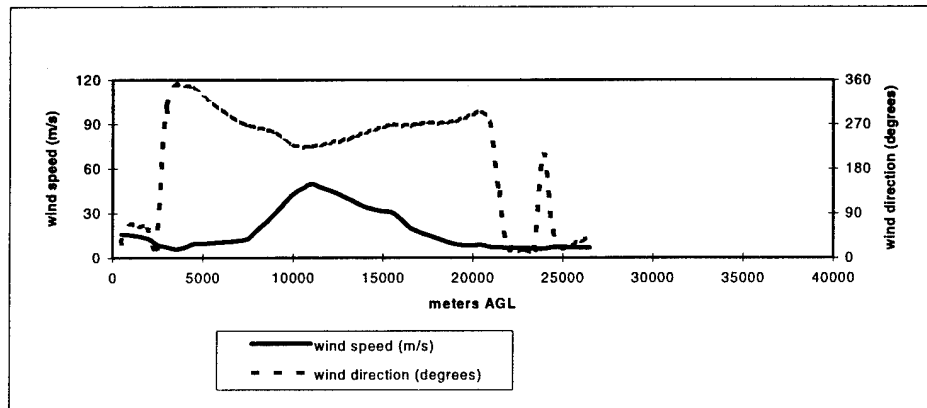
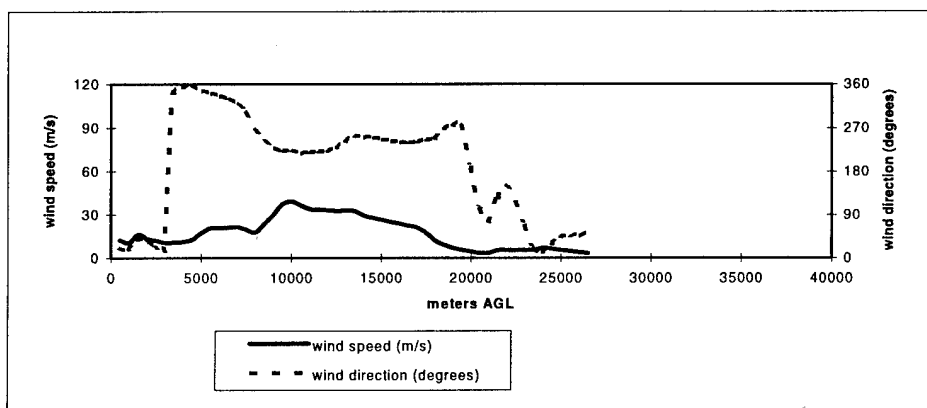


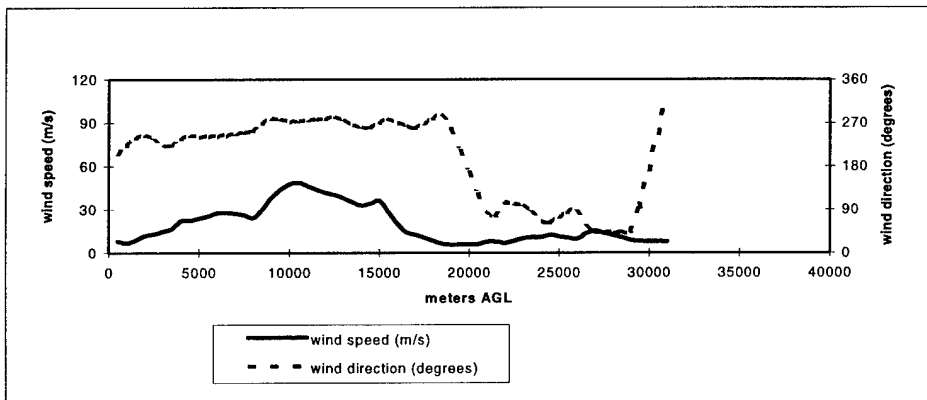
Figure 327. Pokang 910920-1200



**Figure 328. Pokang 911009-1200**



**Figure 329. Pokang 911010-1200**



**Figure 330. Pokang 911016-1200**

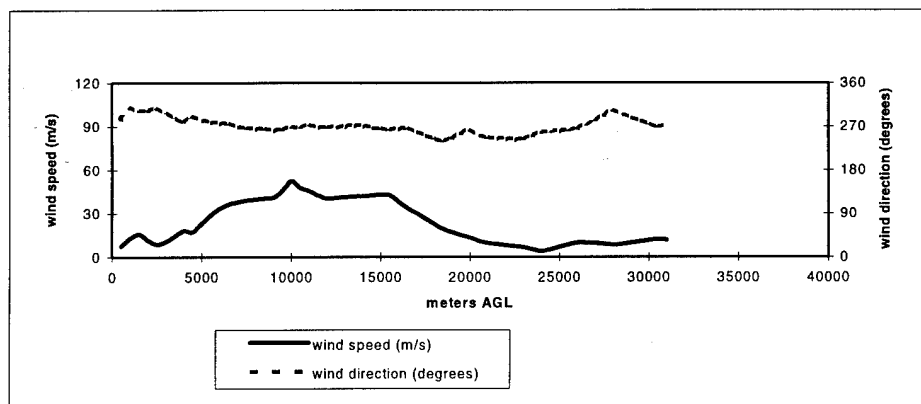


Figure 331. Pokang 911021-0000

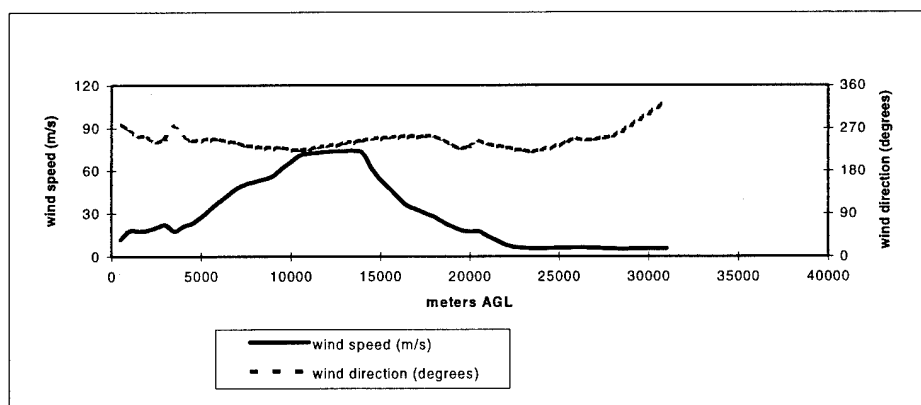


Figure 332. Pokang 911027-0000

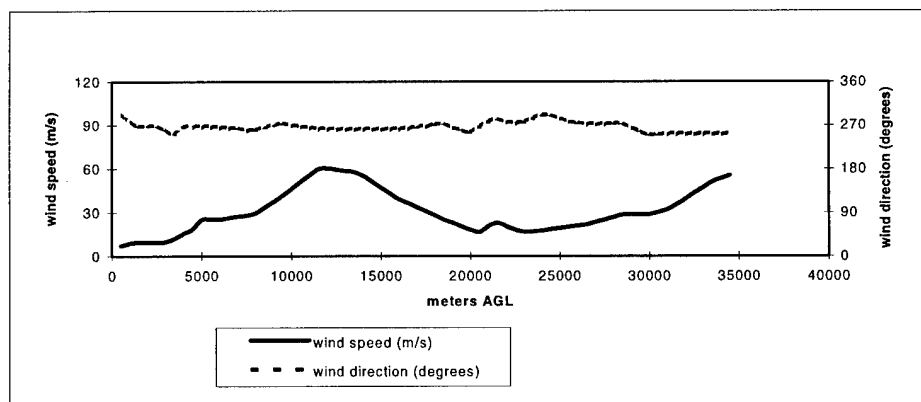
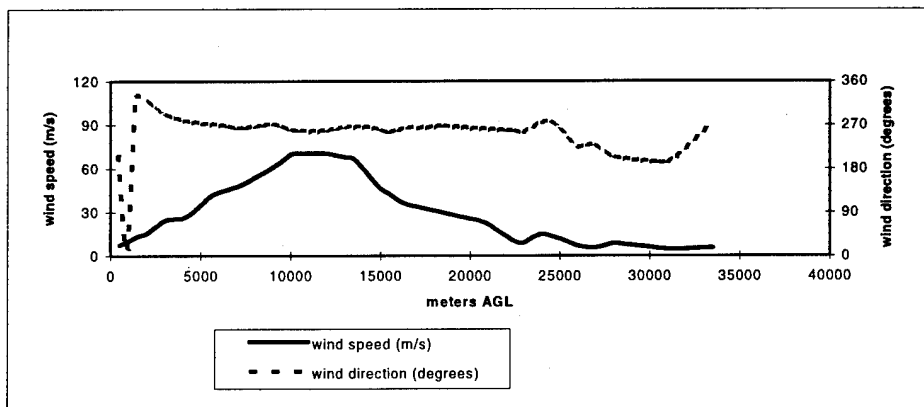
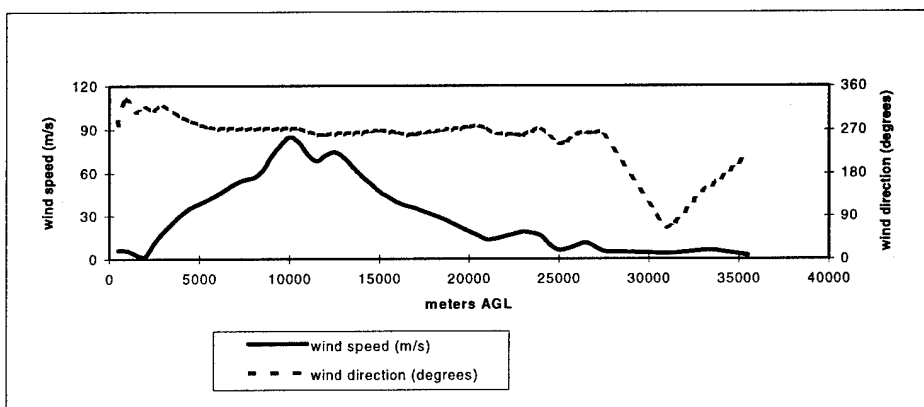


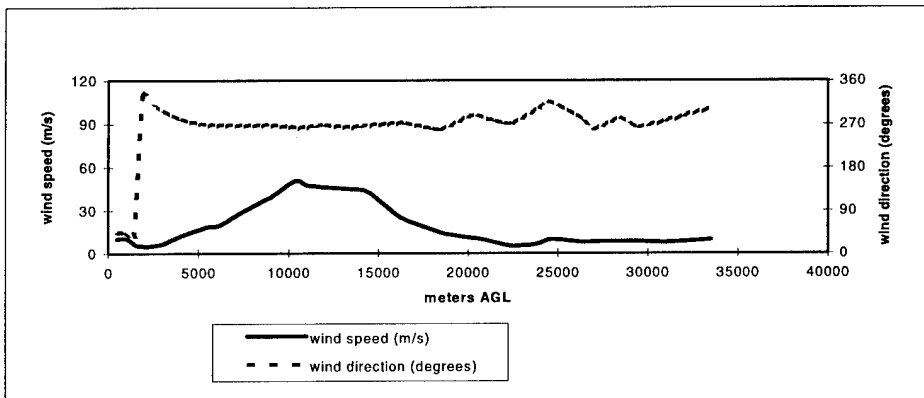
Figure 333. Pokang 911121-0000



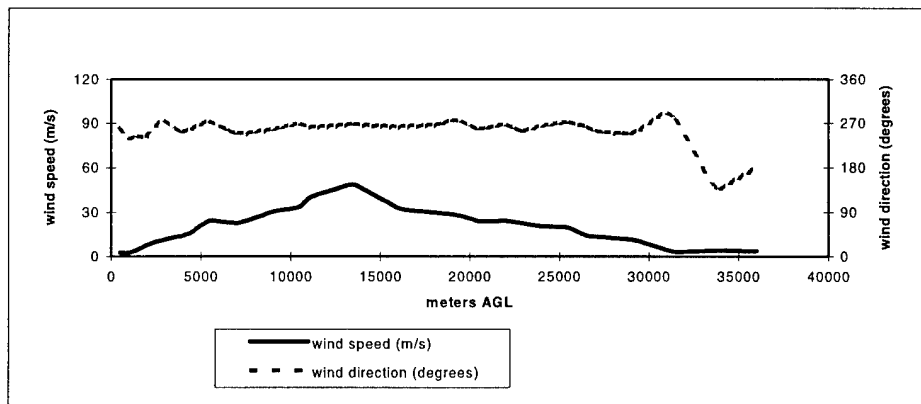
**Figure 334. Pokang 911124-0000**



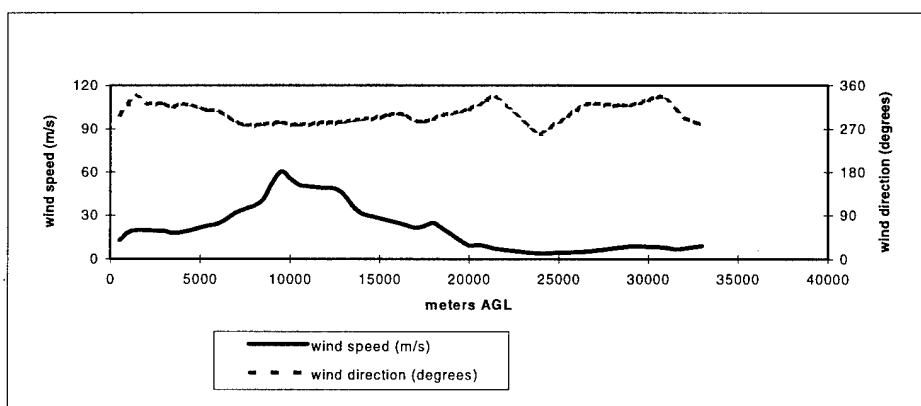
**Figure 335. Pokang 911124-1200**



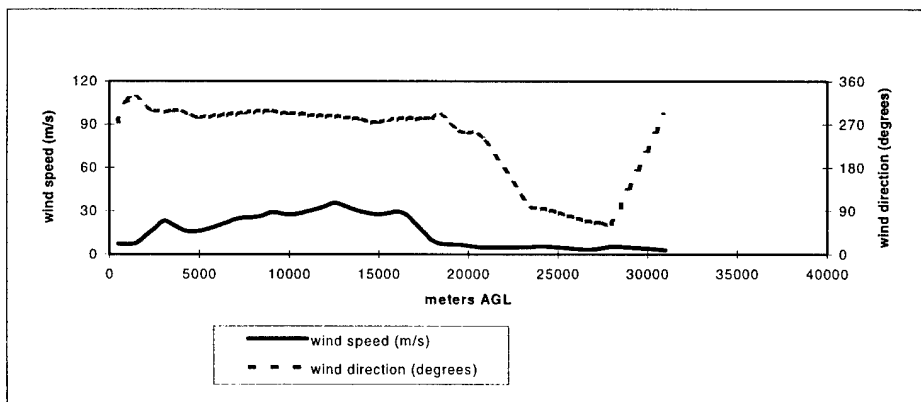
**Figure 336. Pokang 920302-0000**



**Figure 337. Pokang 920309-0000**



**Figure 338. Pokang 920502-0000**



**Figure 339. Pokang 920522-0000**

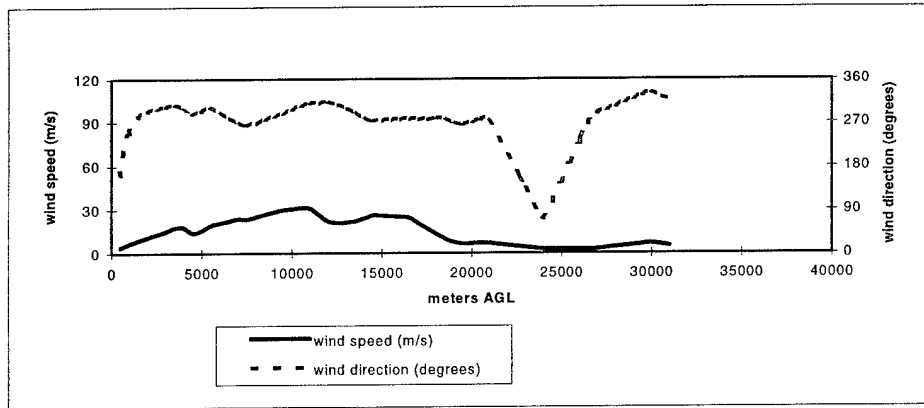


Figure 340. Pokang 920605-1200

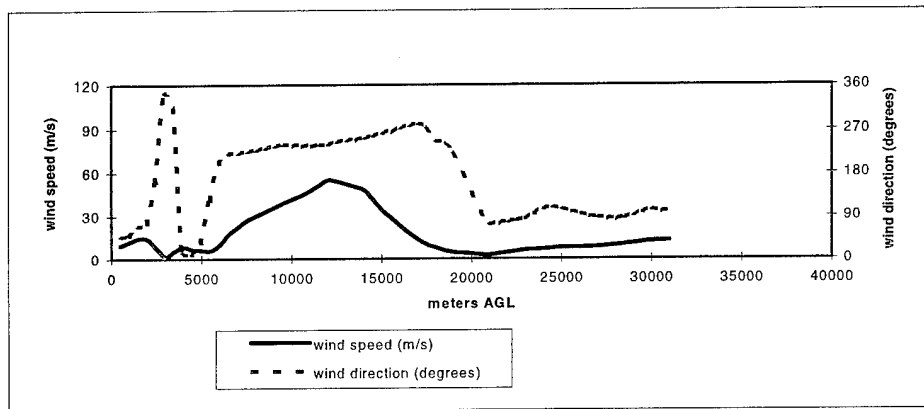


Figure 341. Pokang 920623-0000

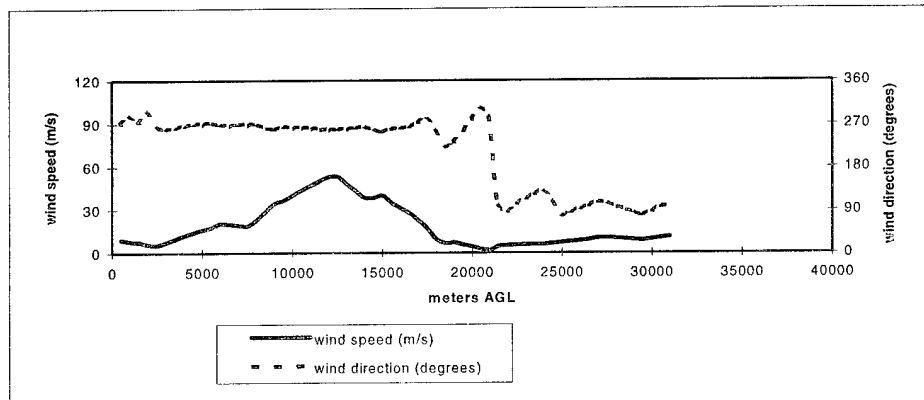


Figure 342. Pokang 920701-0000



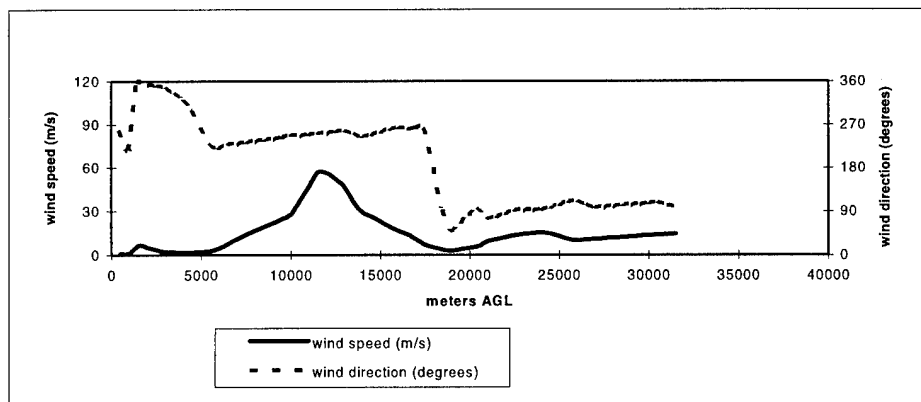


Figure 343. Pokang 920707-0000

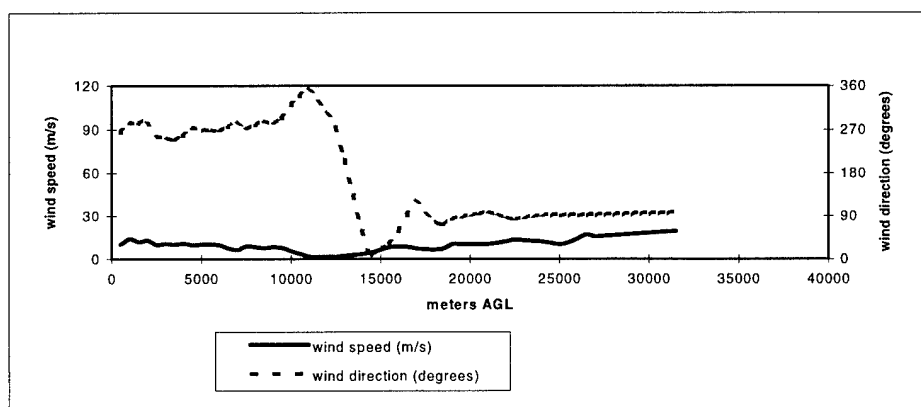


Figure 344. Pokang 920727-0000

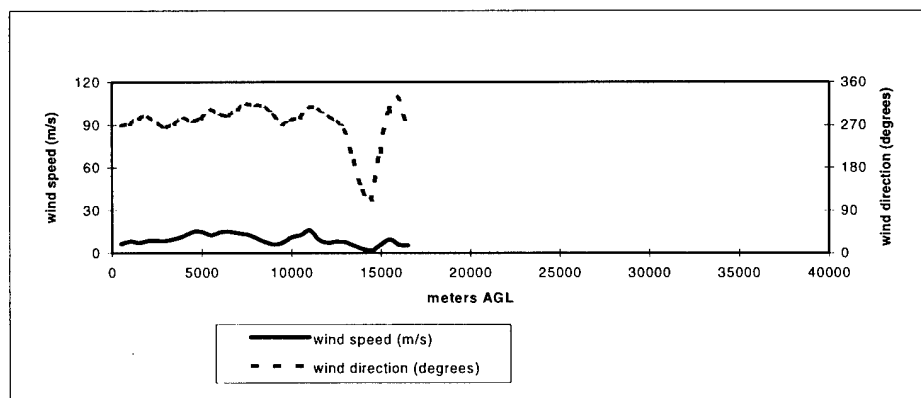
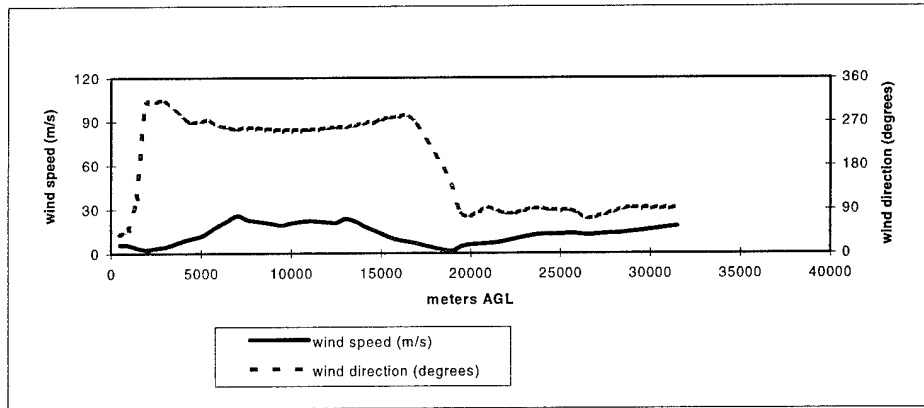
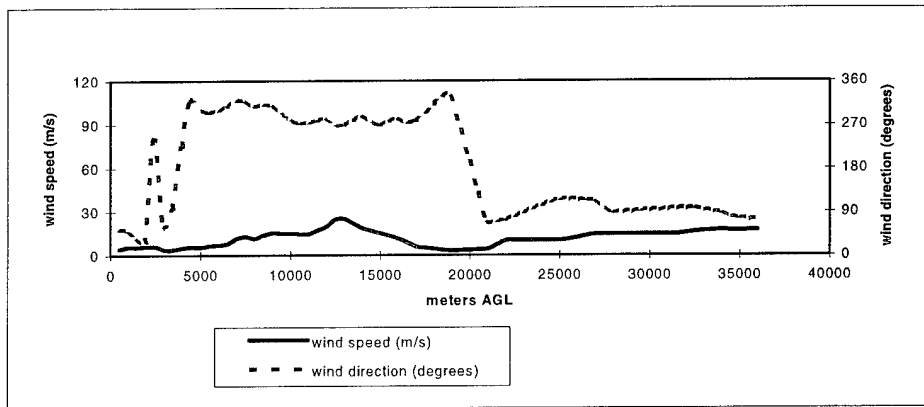


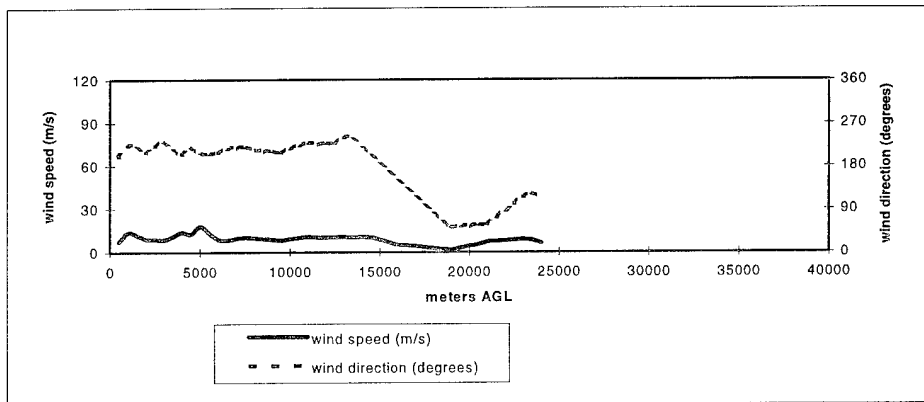
Figure 345. Pokang 920727-1200



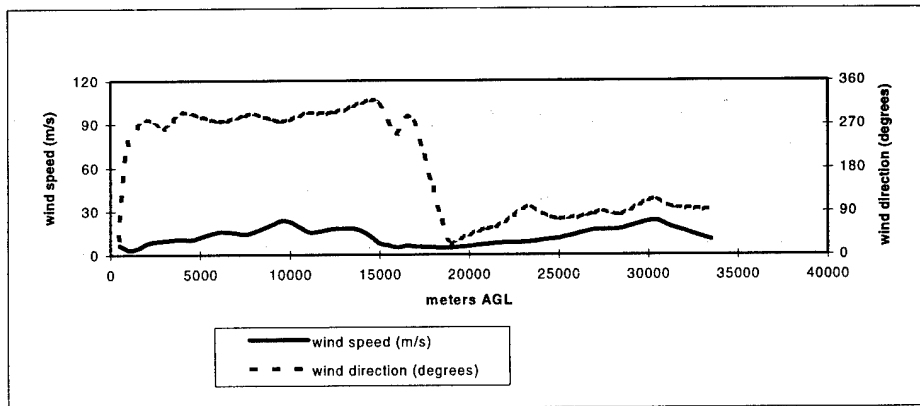
**Figure 346. Pokang 920801-0000**



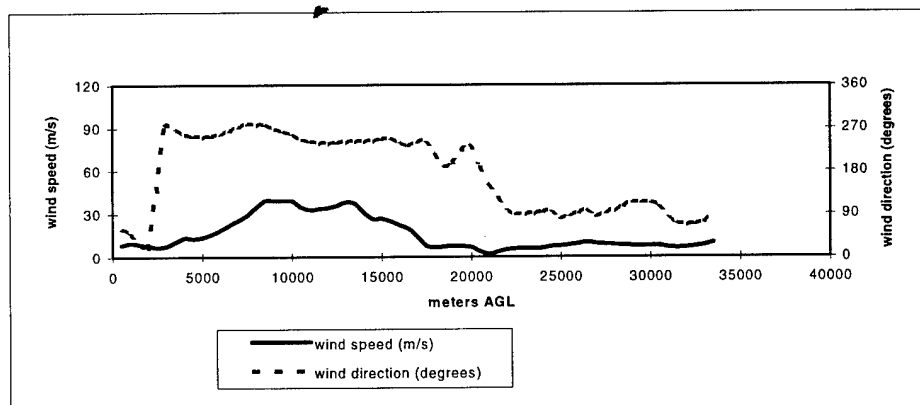
**Figure 347. Pokang 920802-0000**



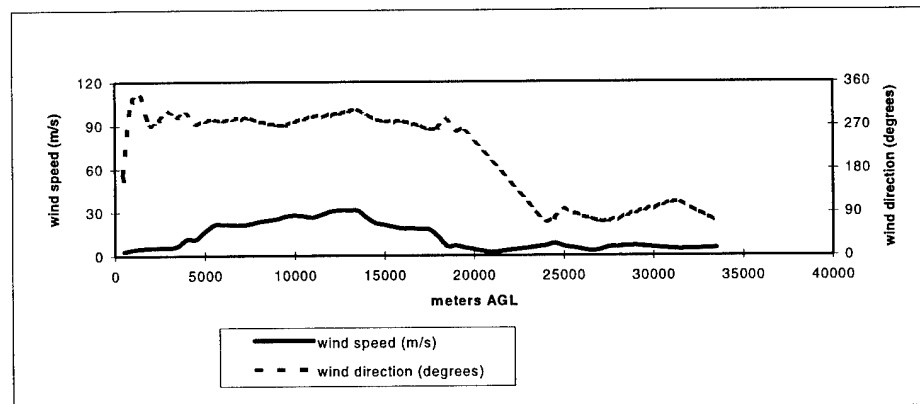
**Figure 348. Pokang 920805-1200**



**Figure 349. Pokang 920809-0000**



**Figure 350. Pokang 920910-0000**



**Figure 351. Pokang 920914-1200**

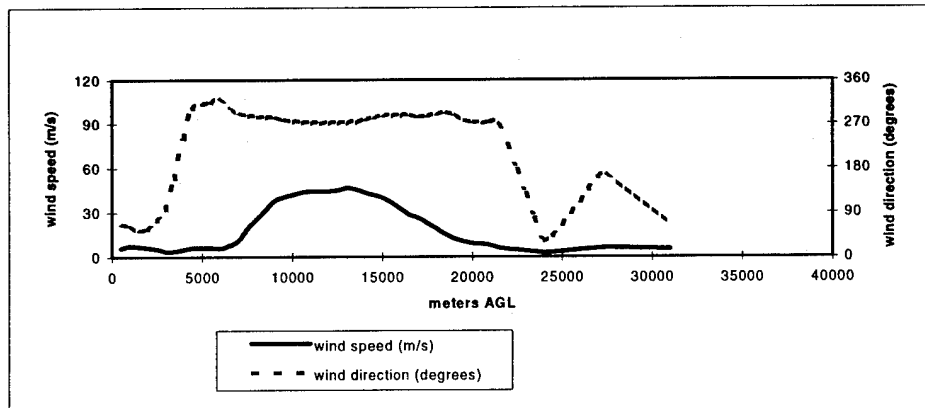


Figure 352. Pokang 920921-1200

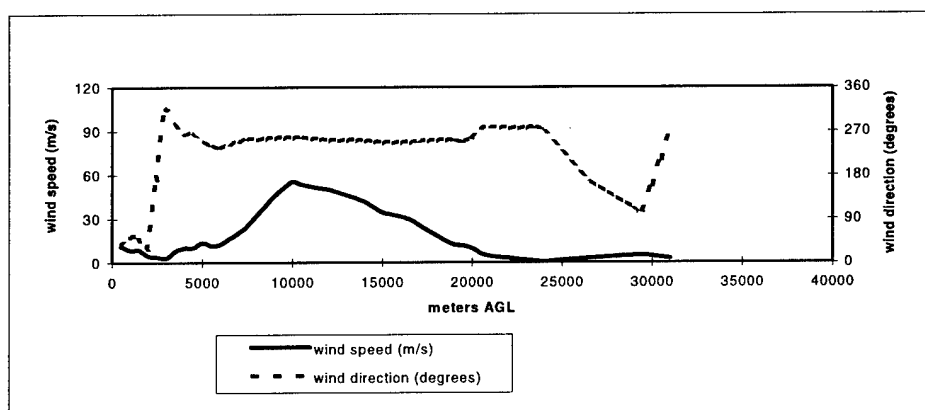


Figure 353. Pokang 921015-0000

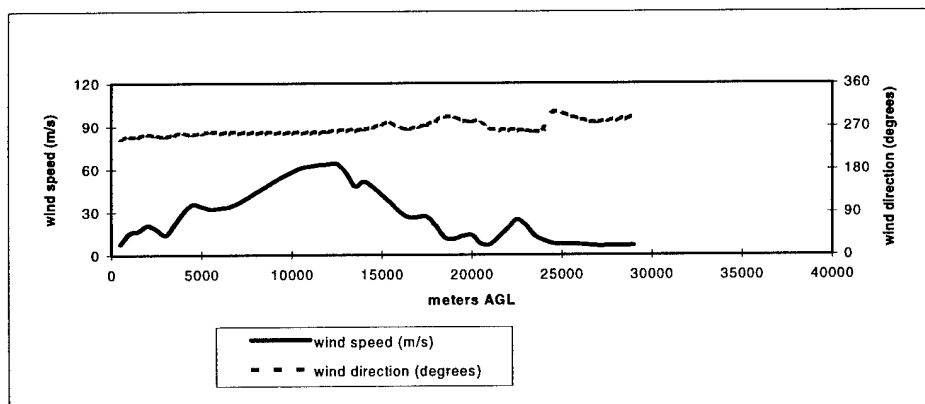


Figure 354. Pokang 921029-1200

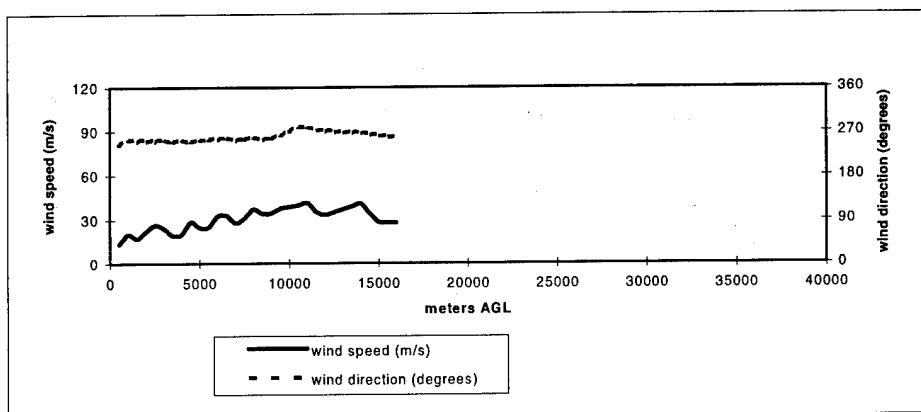


Figure 355. Pokang 921103-0000

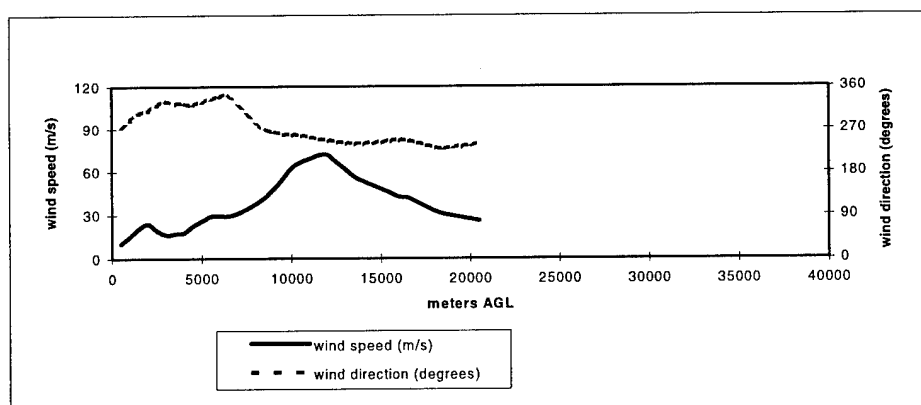


Figure 356. Pokang 921110-1200

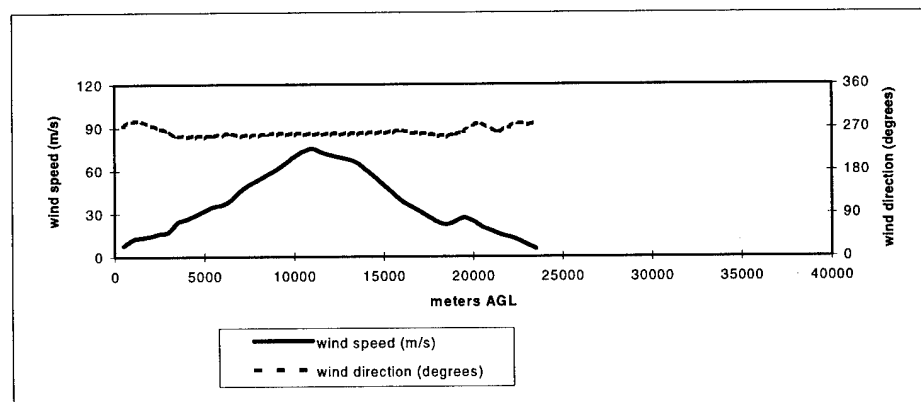
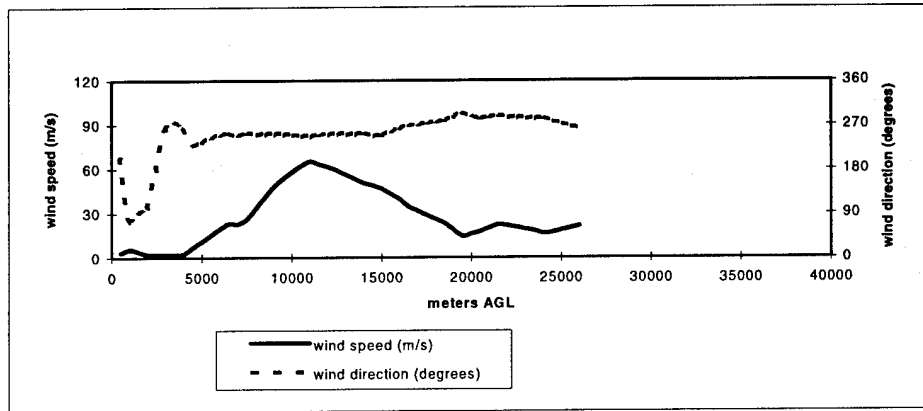
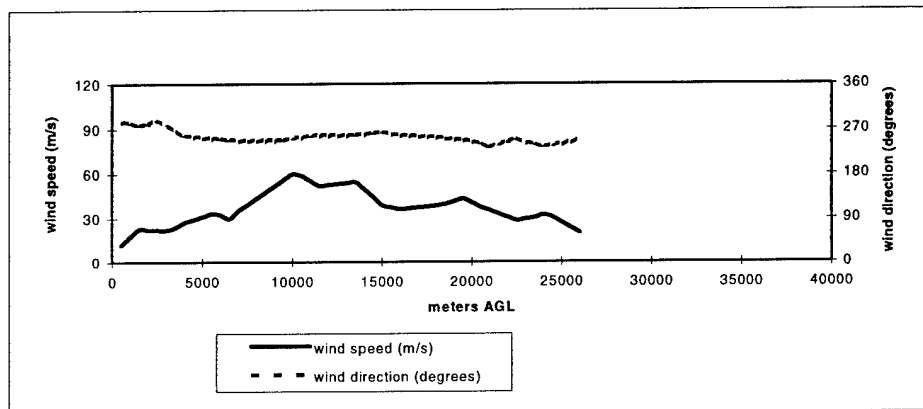


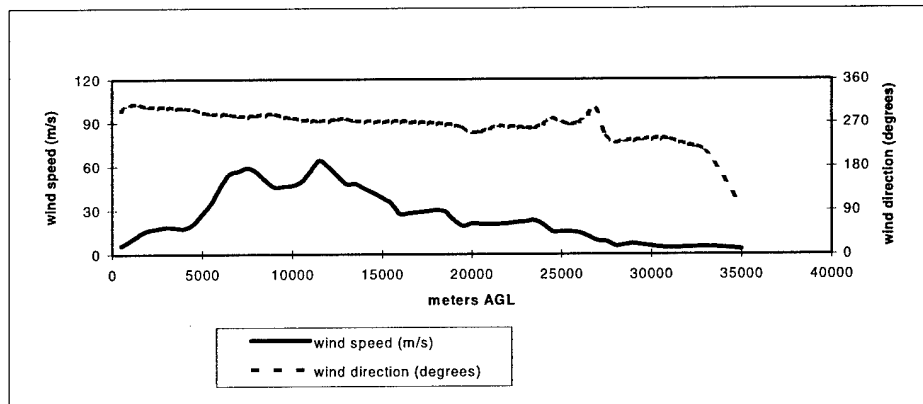
Figure 357. Pokang 921125-0000



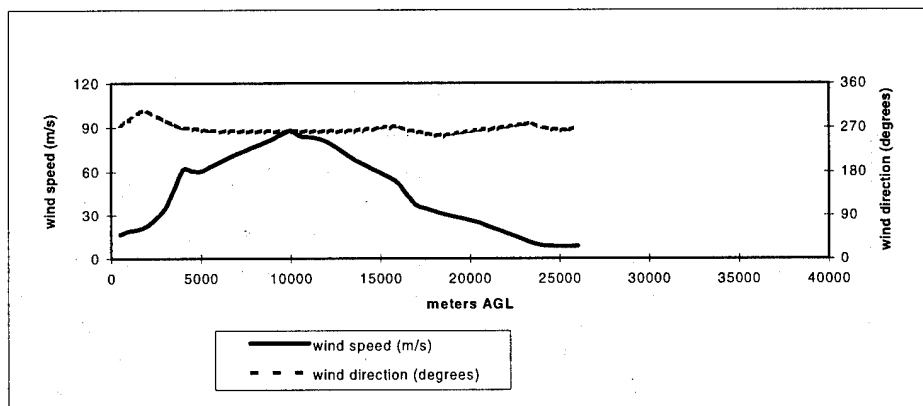
**Figure 358. Pokang 921130-0000**



**Figure 359. Pokang 921210-1200**



**Figure 360. Pokang 921217-1200**



**Figure 361. Pokang 921223-0000**

## 6.7 Cheju, South Korea

**Table 13. Table of Spread Distances (m), Cheju, South Korea**

Order Statistic	Intercept Altitude					
	5 km			10 km		
	Spread Distance	Date/Time	Figure No.	Spread Distance	Date/Time	Figure No.
Minimum	662.	920820-1200	413	3434.	920806-1200	408
5th percentile	3965.	910623-1200	374	16419.	910820-0000	378
10th percentile	5491.	920703-0000	402	20761.	920706-0000	404
25th percentile	9055.	911102-1200	384	32976.	920816-0000	411
Median	14837.	921026-1200	419	48485.	920604-0000	399
75th percentile	22242.	910525-0000	371	67448.	910418-0000	369
90th percentile	29175.	920929-0000	416	86285.	920217-1200	391
95th percentile	32713.	910109-0000	362	97044.	921228-0000	420
Maximum	51004.	910601-0000	373	124448.	910204-0000	363
Number of Valid Profiles	983			962		

Order Statistic	Intercept Altitude					
	20 km			30 km		
	Spread Distance	Date/Time	Figure No.	Spread Distance	Date/Time	Figure No.
Minimum	4682.	910719-0000	376	6693.	910820-0000	378
5th percentile	28122.	920723-0000	406	24348.	910526-0000	372
10th percentile	45060.	920819-0000	412	33405.	920808-1200	410
25th percentile	76075.	920617-0000	401	57658.	920407-0000	394
Median	115620.	920611-1200	400	98853.	911105-1200	386
75th percentile	157933.	920109-0000	388	142505.	920128-0000	389
90th percentile	197181.	911122-0000	387	183445.	910330-0000	368
95th percentile	214813.	910225-0000	366	205203.	910302-1200	367
Maximum	276493.	910221-1200	365	257856.	920226-0000	392
Number of Valid Profiles	852			382		



**Table 14. Table of Travel Distances (m), Cheju, South Korea**

Order Statistic	Intercept Altitude					
	5 km			10 km		
	Travel Distance	Date/Time	Figure No.	Travel Distance	Date/Time	Figure No.
Minimum	233.	920820-1200	413	1141.	920806-1200	408
5th percentile	1353.	910818-1200	377	5167.	910908-0000	380
10th percentile	1874.	920706-1200	405	6662.	920822-0000	414
25th percentile	3168.	911030-0000	383	10457.	920930-1200	417
Median	5047.	911011-0000	382	15291.	920518-1200	397
75th percentile	7606.	910517-1200	370	21318.	920416-0000	396
90th percentile	9996.	920929-0000	416	27322.	910919-1200	381
95th percentile	11204.	910109-0000	362	30890.	910225-0000	366
Maximum	17514.	910601-0000	373	39319.	910204-0000	363
Number of Valid Profiles	983			962		

Order Statistic	Intercept Altitude					
	20 km			30 km		
	Travel Distance	Date/Time	Figure No.	Travel Distance	Date/Time	Figure No.
Minimum	1192.	910719-0000	376	1770.	910820-0000	378
5th percentile	8474.	920828-1200	415	7002.	920807-0000	409
10th percentile	13008.	910908-0000	380	10154.	920731-1200	407
25th percentile	21295.	921004-0000	418	17415.	910827-0000	379
Median	32027.	910707-0000	375	27972.	920704-0000	403
75th percentile	43983.	920526-0000	398	39126.	911103-1200	385
90th percentile	55589.	920205-0000	390	49064.	920411-0000	395
95th percentile	59688.	920227-0000	393	56672.	910206-0000	364
Maximum	74924.	910221-1200	365	68411.	920226-0000	392
Number of Valid Profiles	852			382		

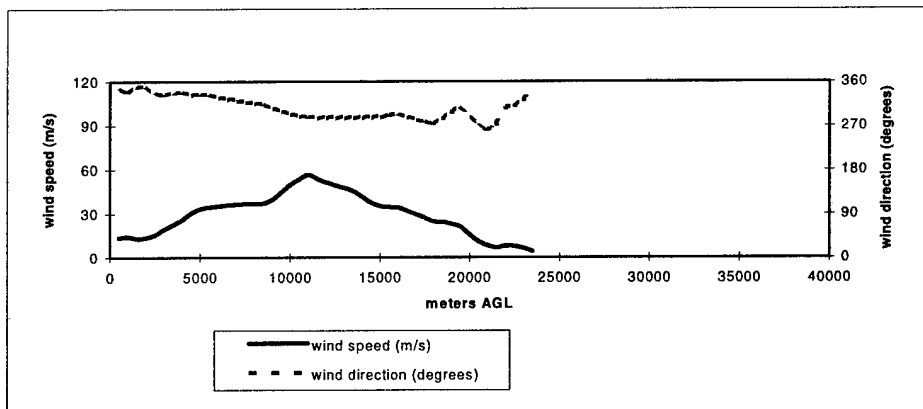


Figure 362. Cheju 910109-0000

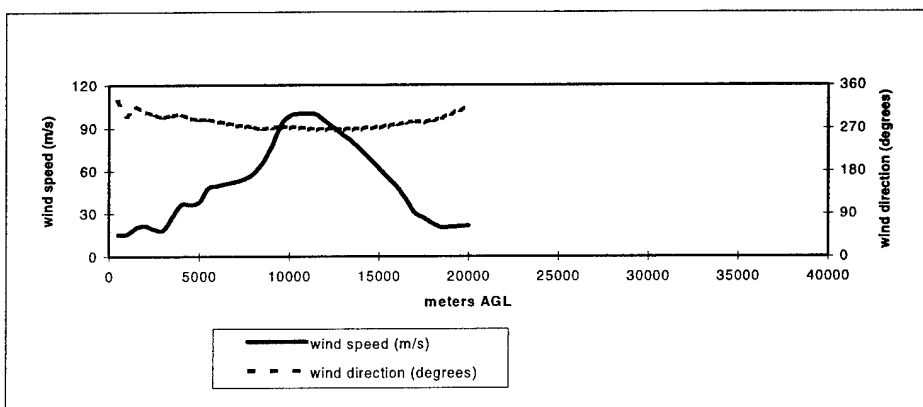


Figure 363. Cheju 910204-0000

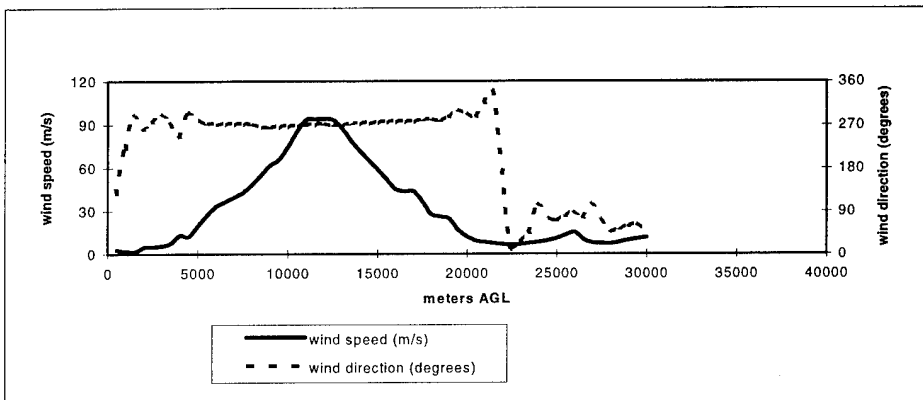


Figure 364. Cheju 910206-0000

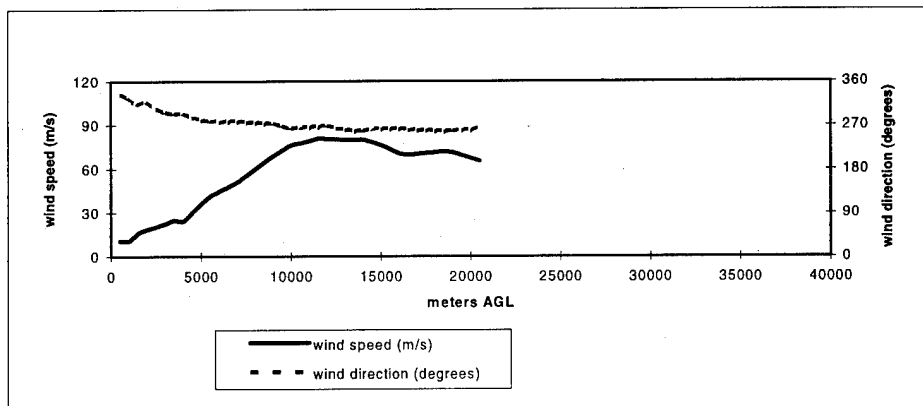


Figure 365. Cheju 910221-1200

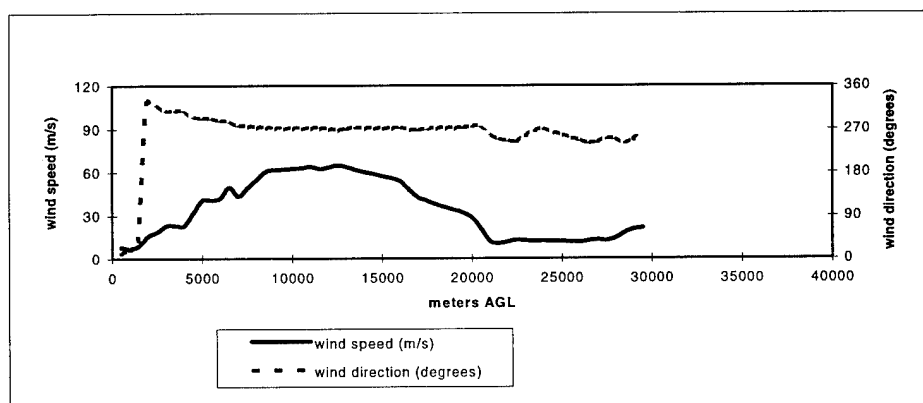


Figure 366. Cheju 910225-0000

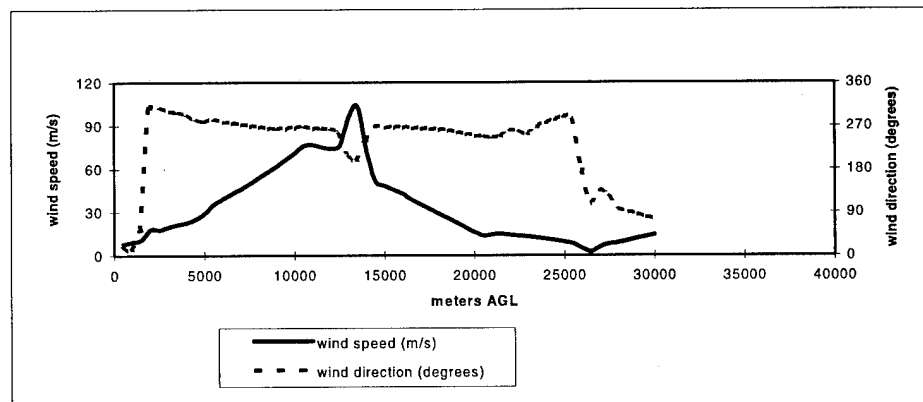
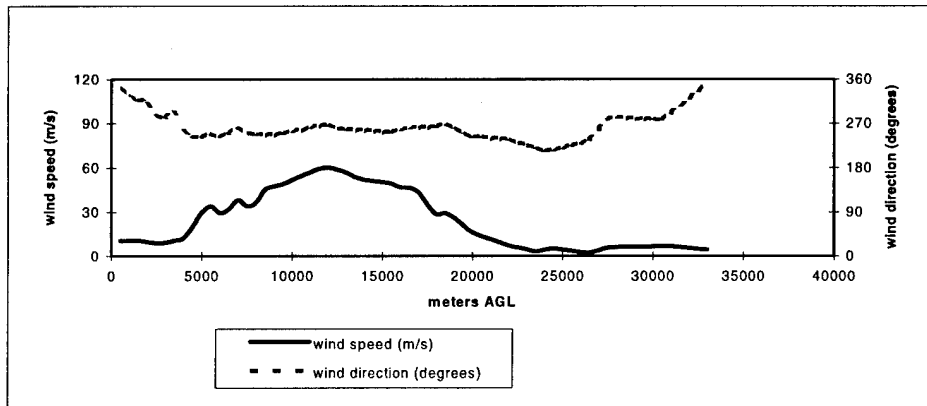
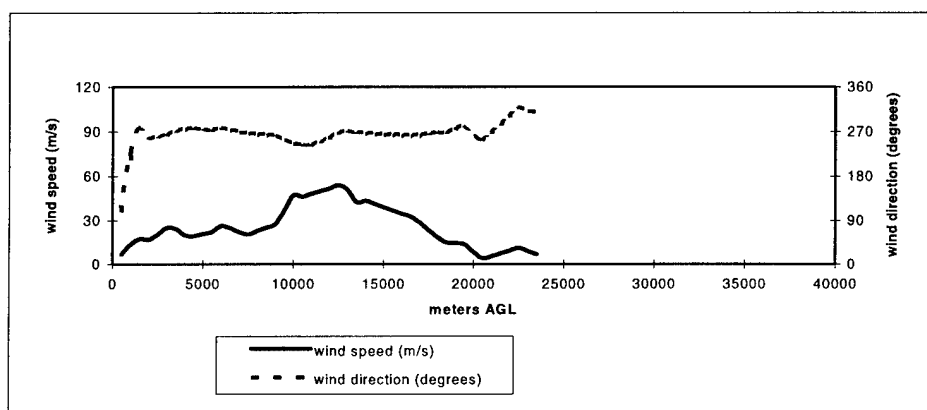


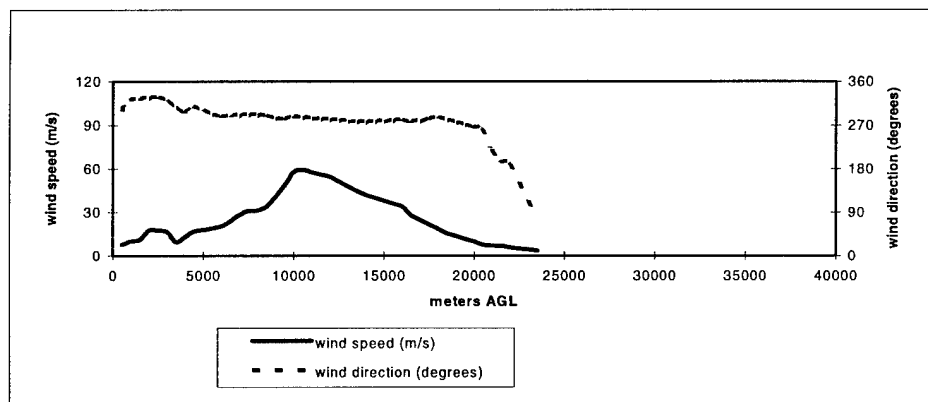
Figure 367. Cheju 910302-1200



**Figure 368. Cheju 910330-0000**



**Figure 369. Cheju 910418-0000**



**Figure 370. Cheju 910517-1200**

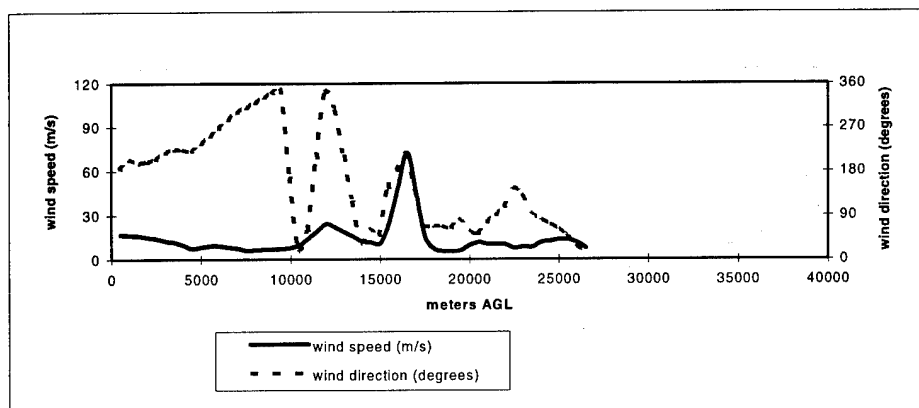


Figure 371. Cheju 910525-0000

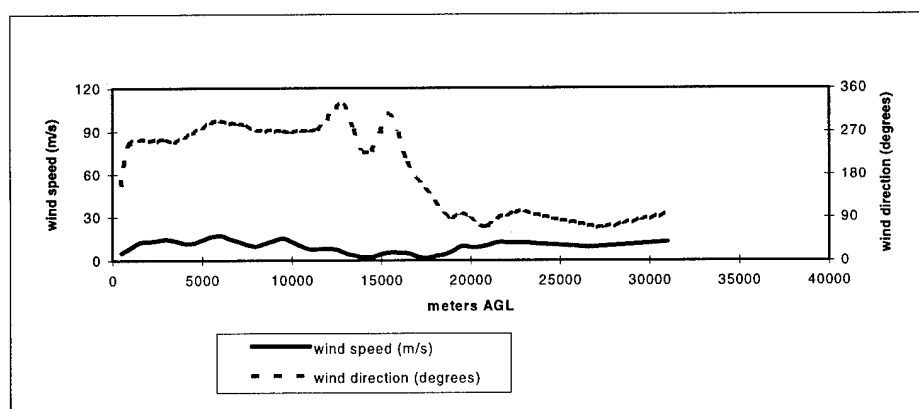


Figure 372. Cheju 910526-0000

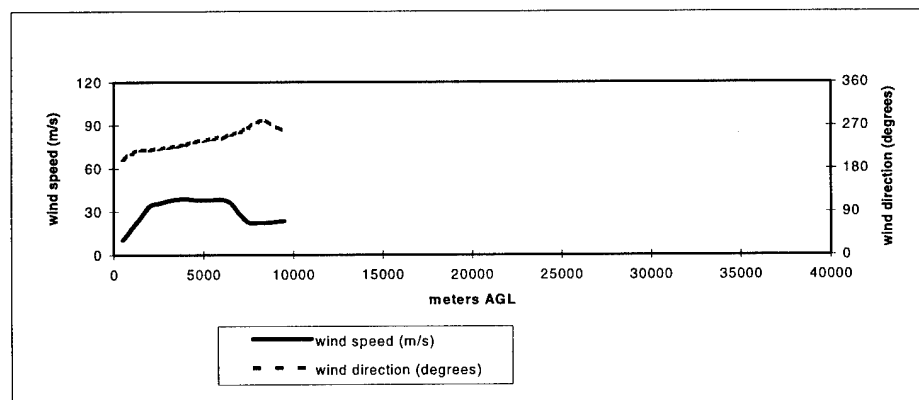


Figure 373. Cheju 910601-0000

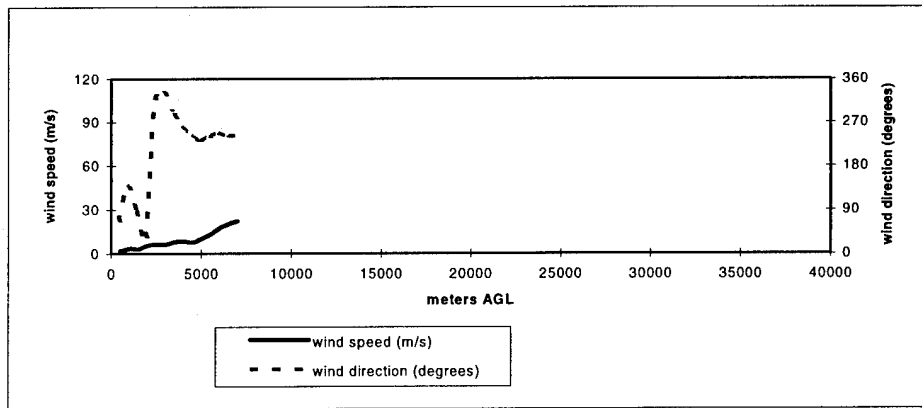


Figure 374. Cheju 910623-1200

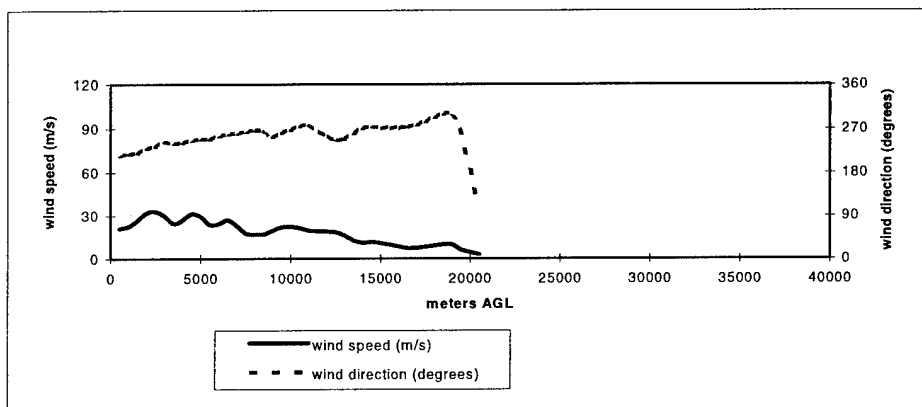


Figure 375. Cheju 910707-0000

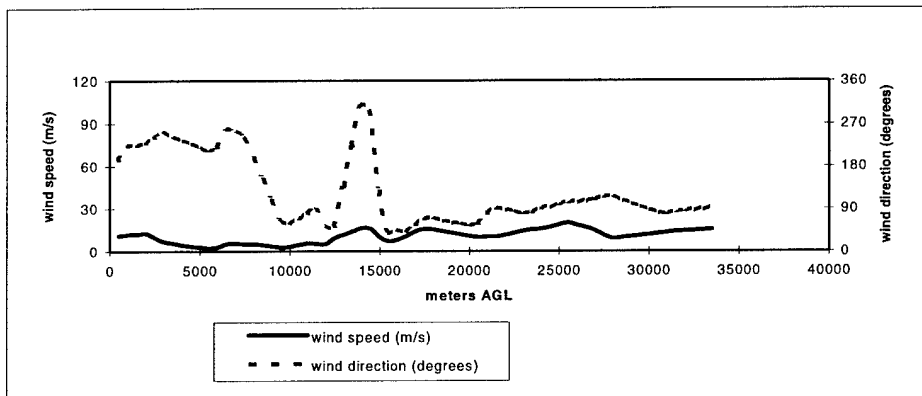


Figure 376. Cheju 910719-0000

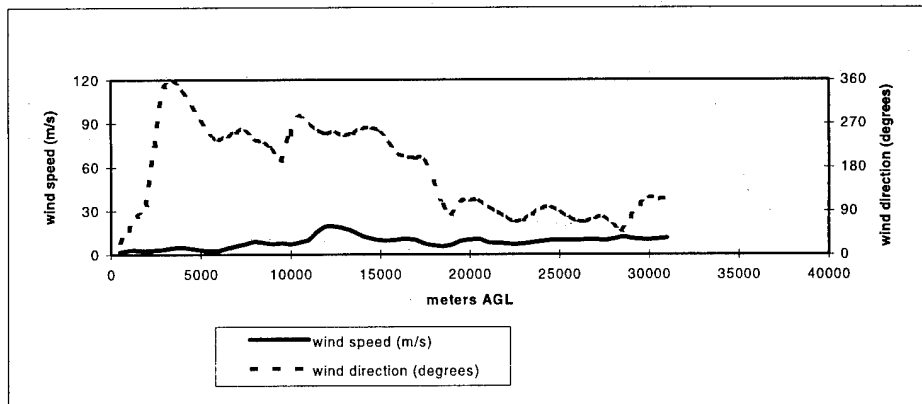


Figure 377. Cheju 910818-1200

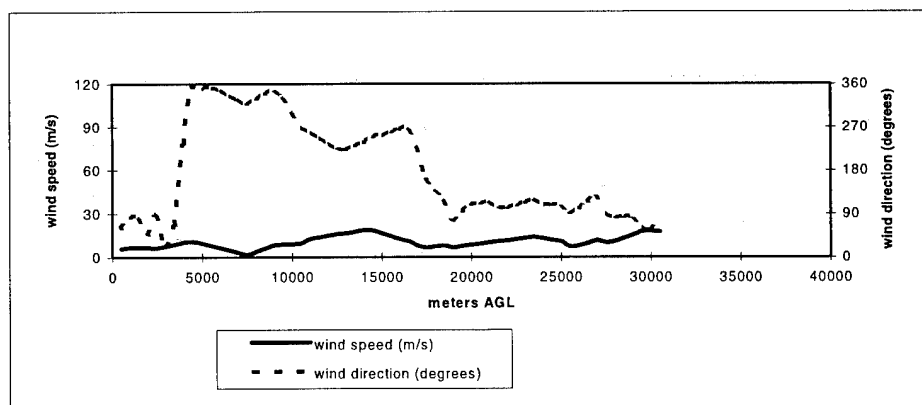


Figure 378. Cheju 910820-0000

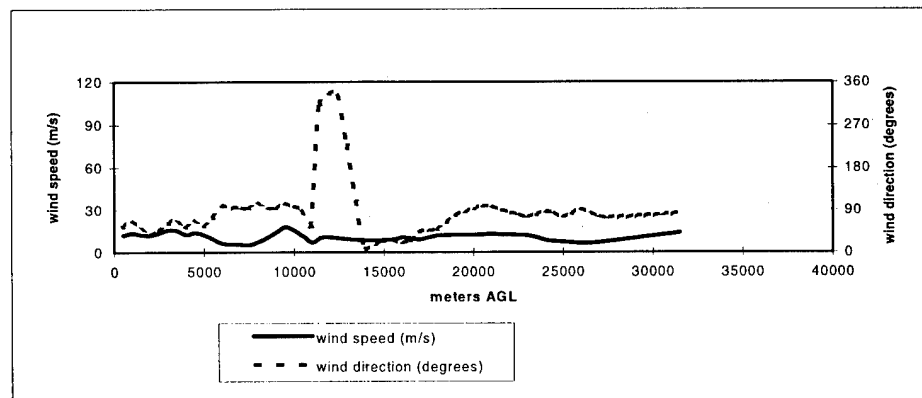
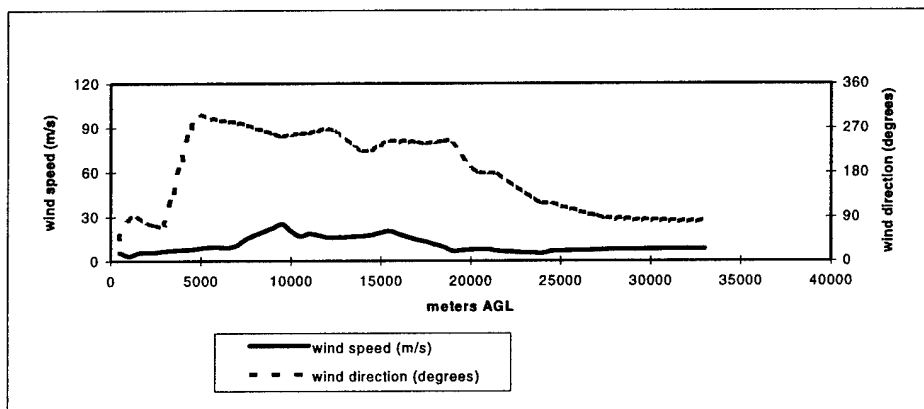
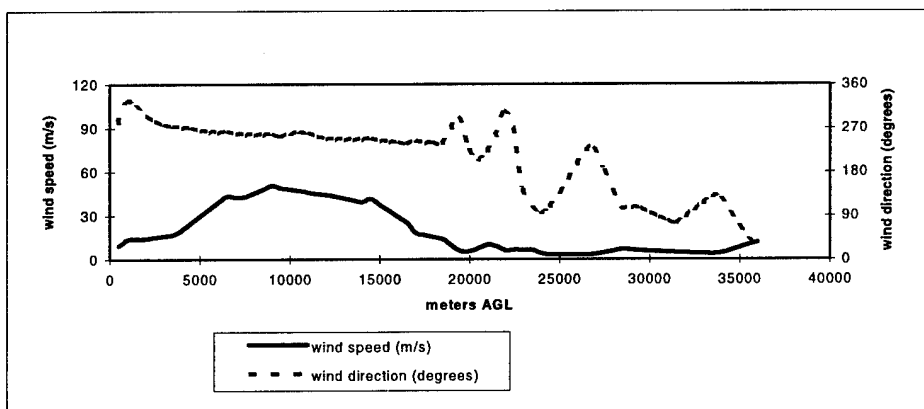


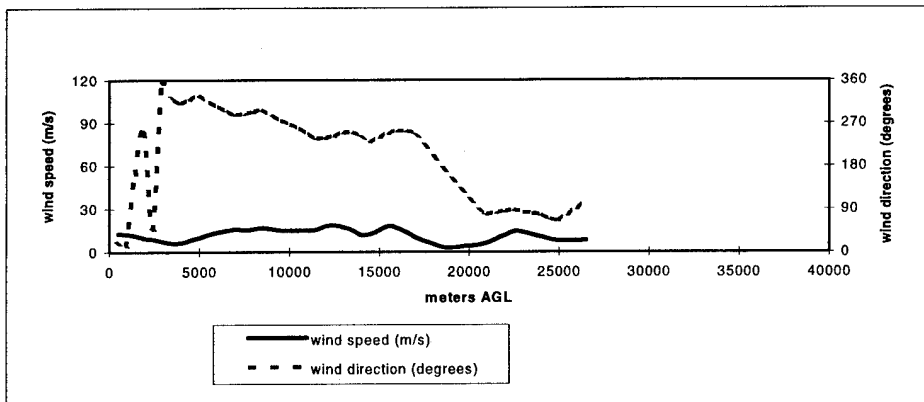
Figure 379. Cheju 910827-0000



**Figure 380. Cheju 910908-0000**

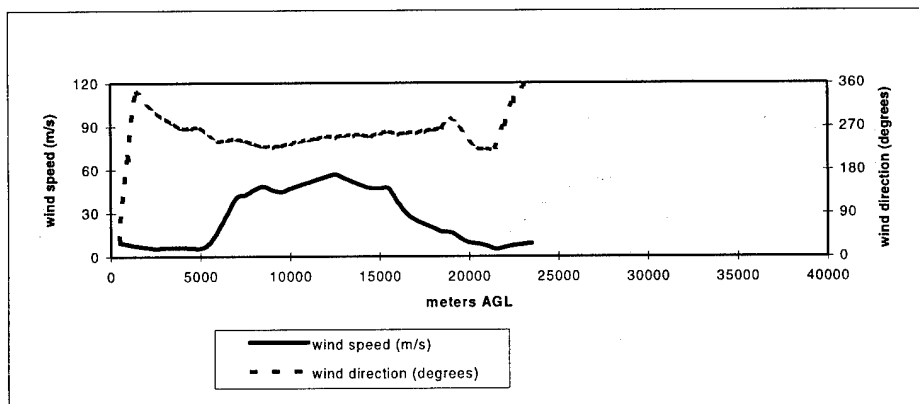


**Figure 381. Cheju 910919-1200**

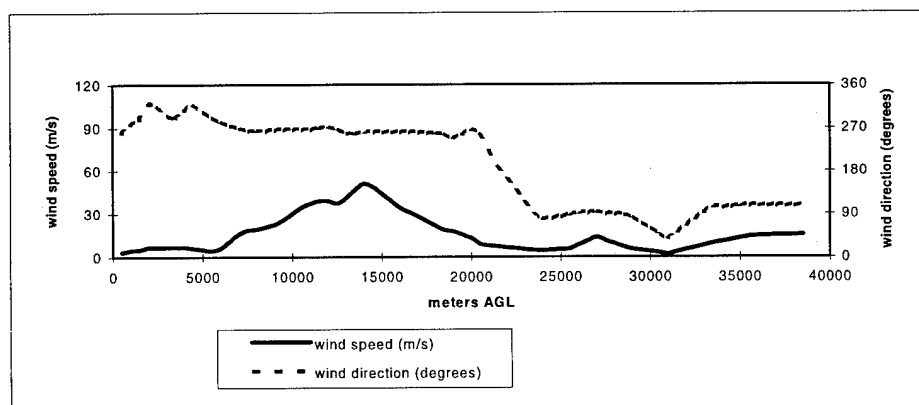


**Figure 382. Cheju 911011-0000**

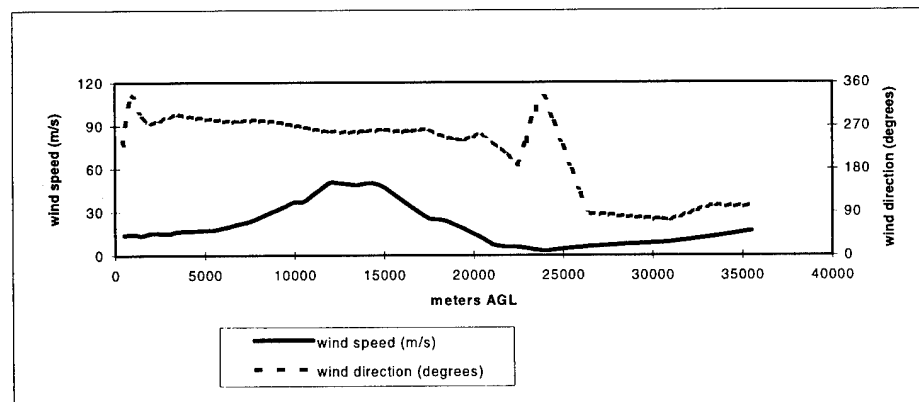




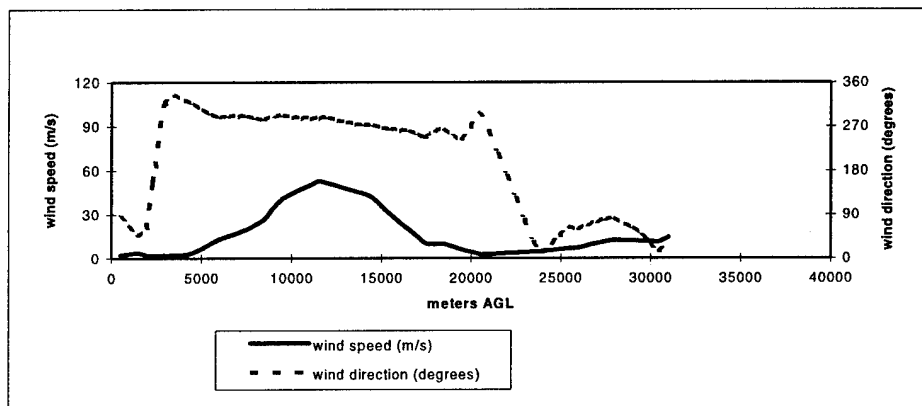
**Figure 383. Cheju 911030-0000**



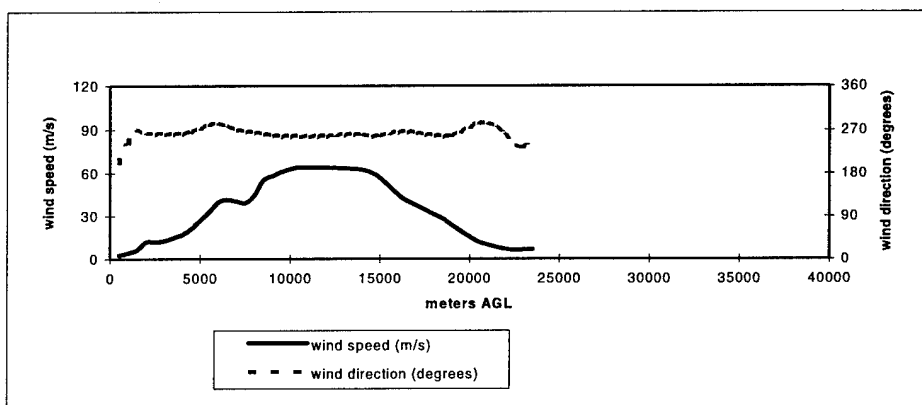
**Figure 384. Cheju 911102-1200**



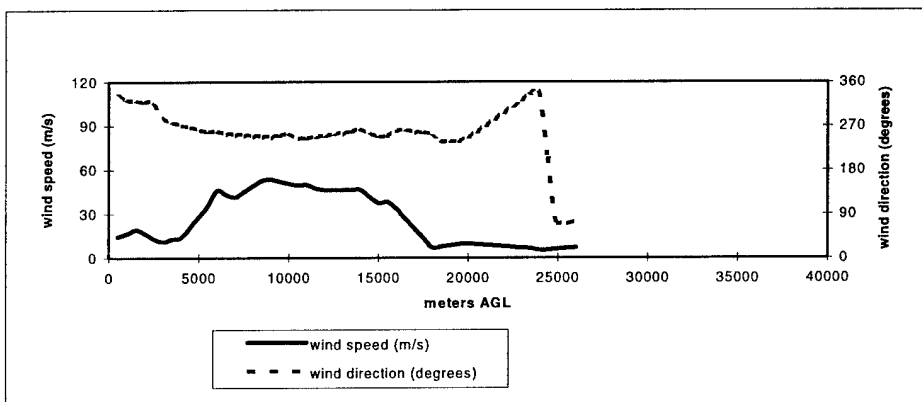
**Figure 385. Cheju 911103-1200**



**Figure 386. Cheju 911105-1200**



**Figure 387. Cheju 911122-0000**



**Figure 388. Cheju 920109-0000**

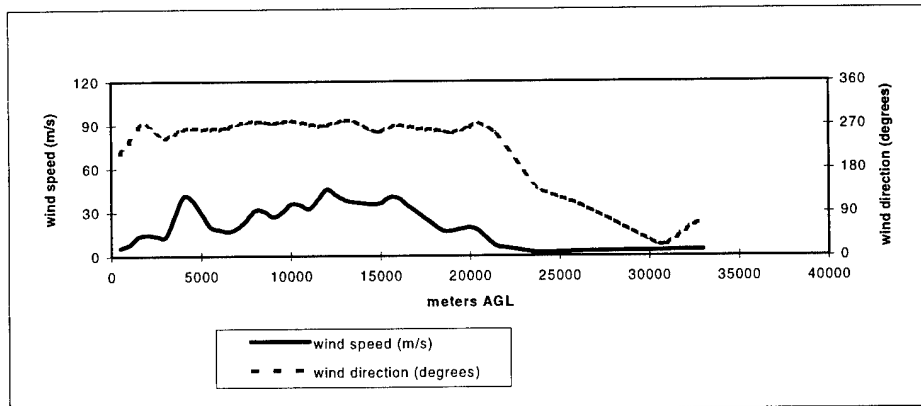


Figure 389. Cheju 920128-0000

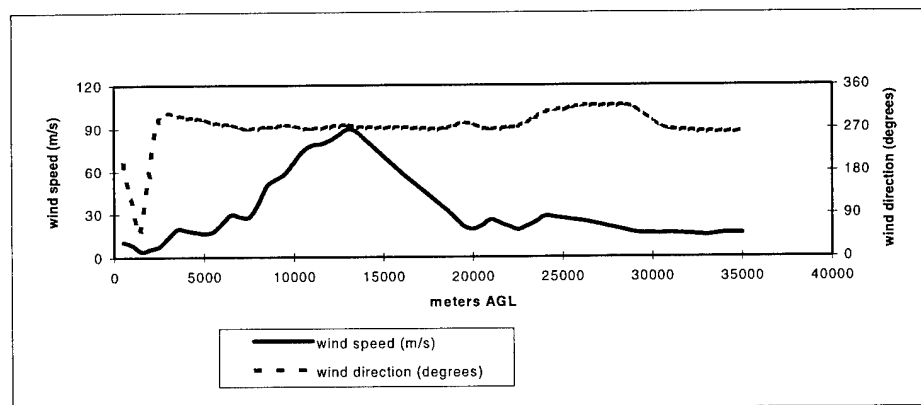


Figure 390. Cheju 920205-0000

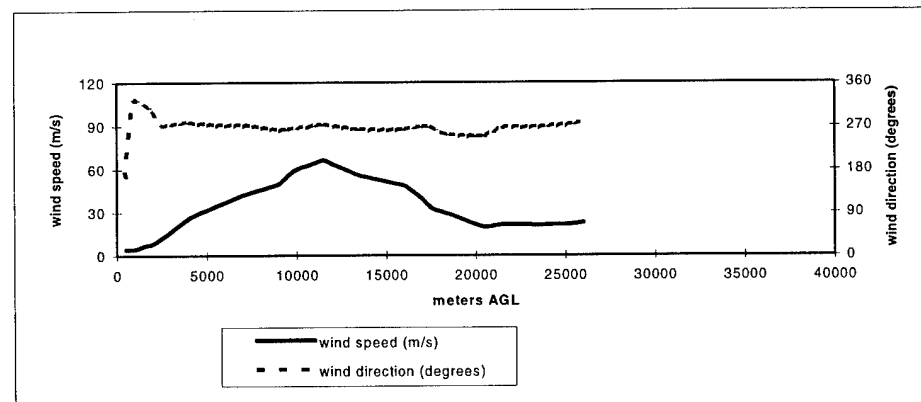
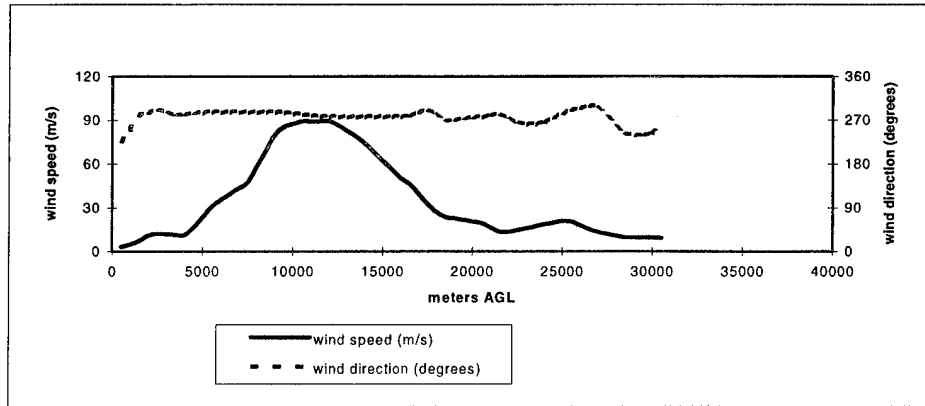
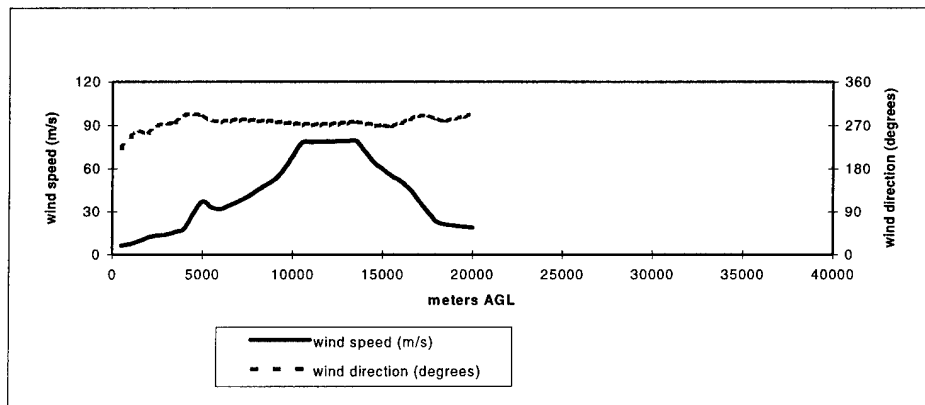


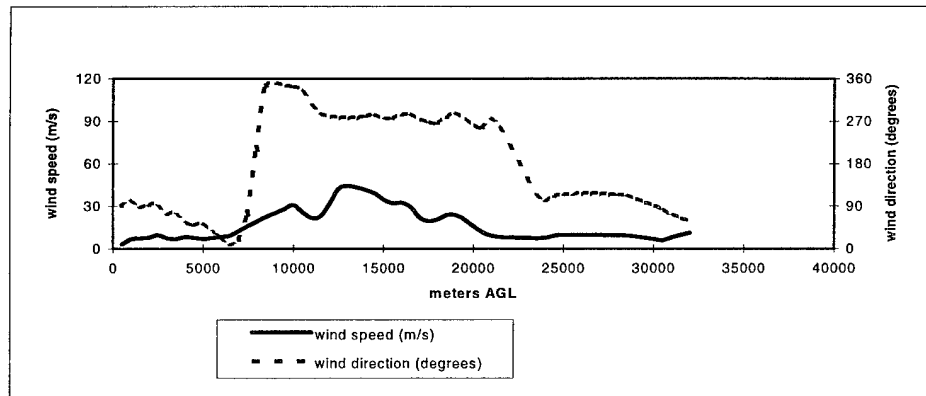
Figure 391. Cheju 920217-1200



**Figure 392. Cheju 920226-0000**



**Figure 393. Cheju 920227-0000**



**Figure 394. Cheju 920407-0000**

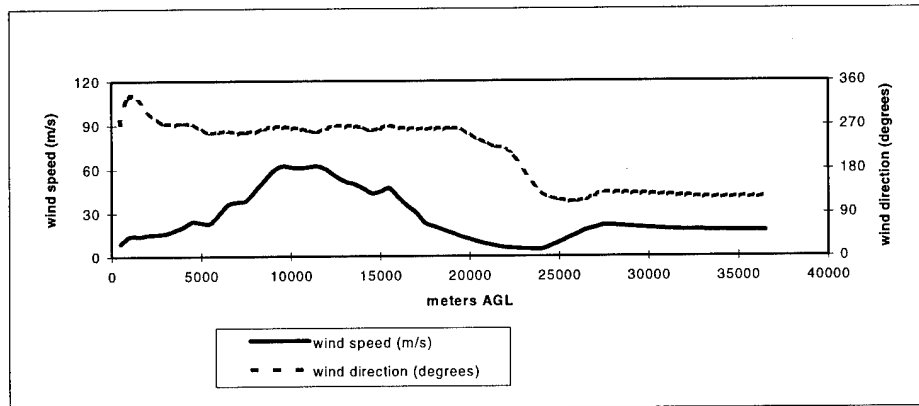


Figure 395. Cheju 920411-0000

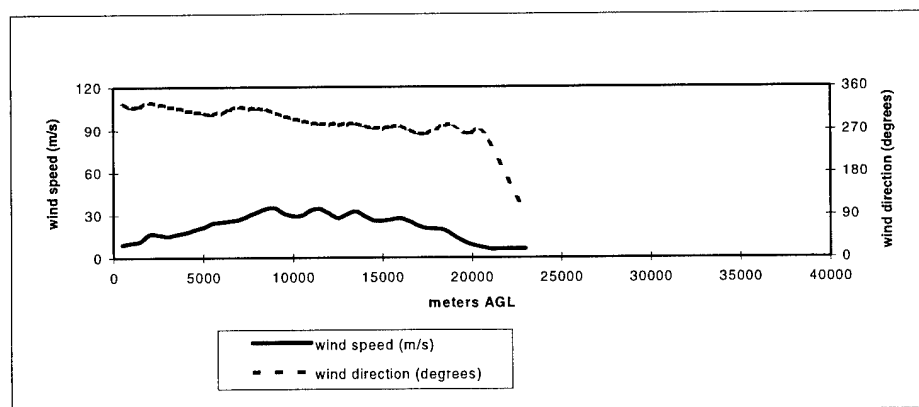


Figure 396. Cheju 920416-0000

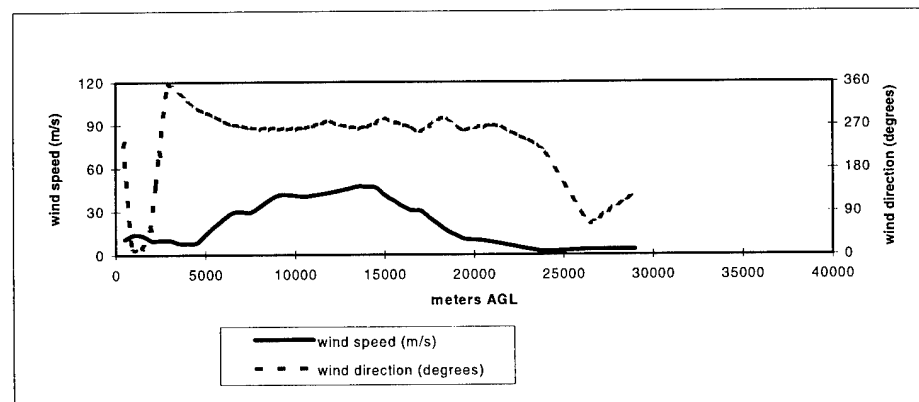
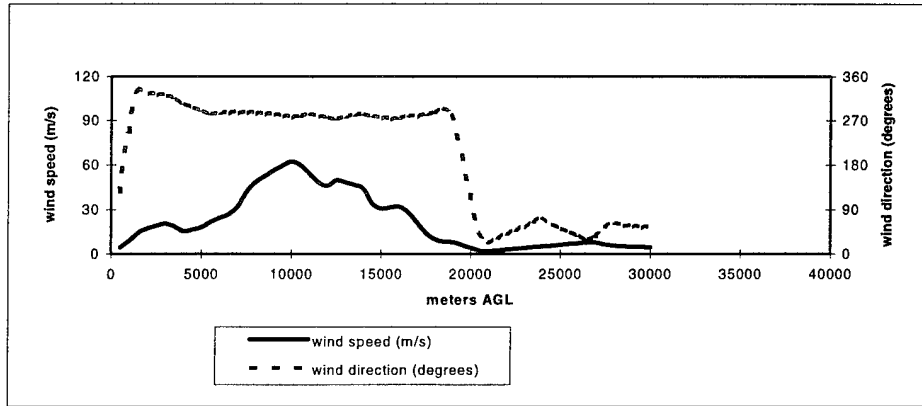
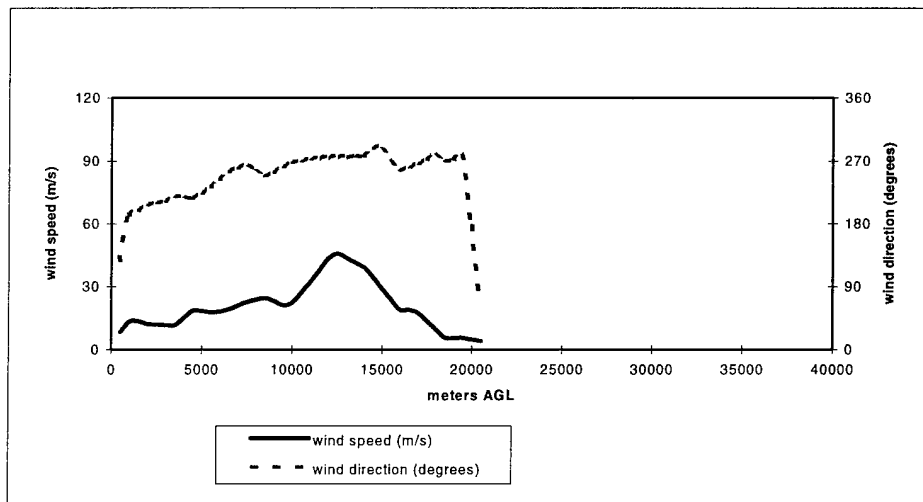


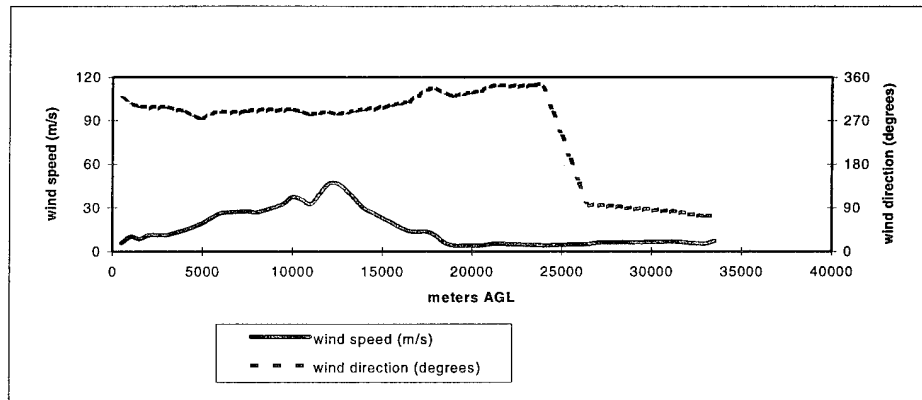
Figure 397. Cheju 920518-1200



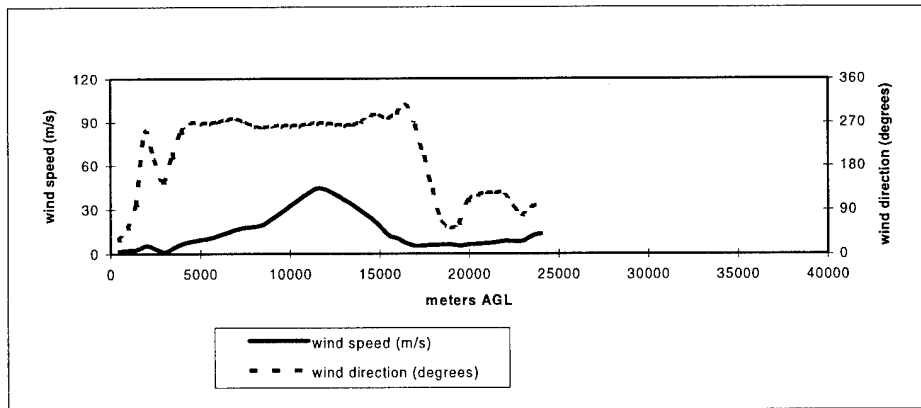
**Figure 398. Cheju 920526-0000**



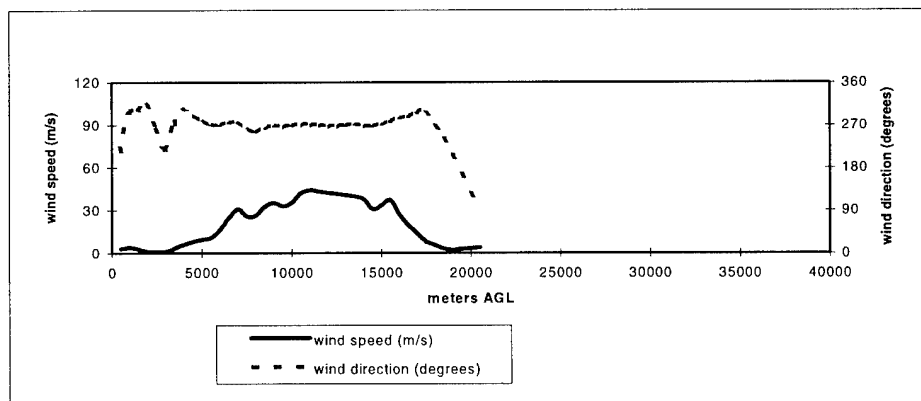
**Figure 399. Cheju 920604-0000**



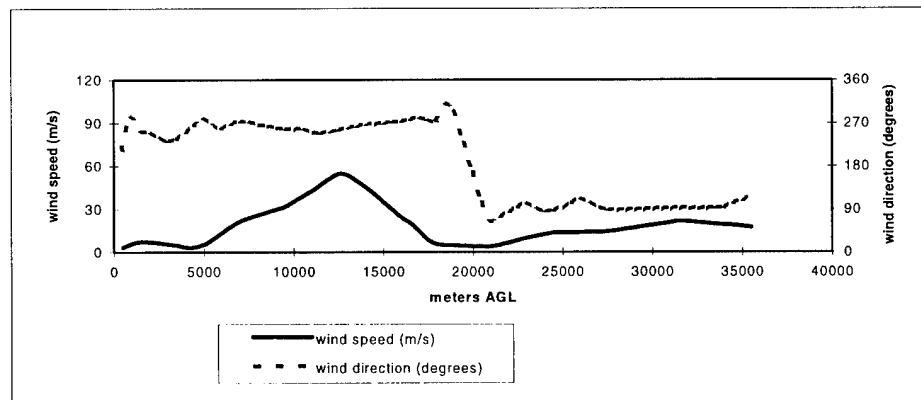
**Figure 400. Cheju 920611-1200**



**Figure 401. Cheju 920617-0000**



**Figure 402. Cheju 920703-0000**



**Figure 403. Cheju 920704-0000**

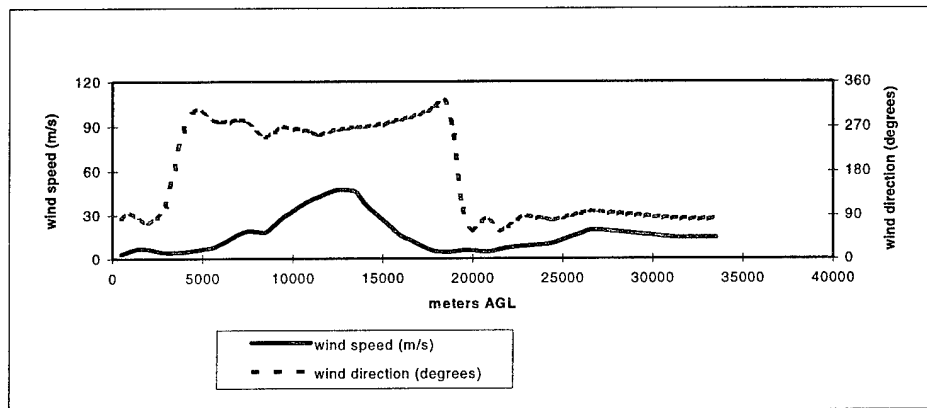


Figure 404. Cheju 920706-0000

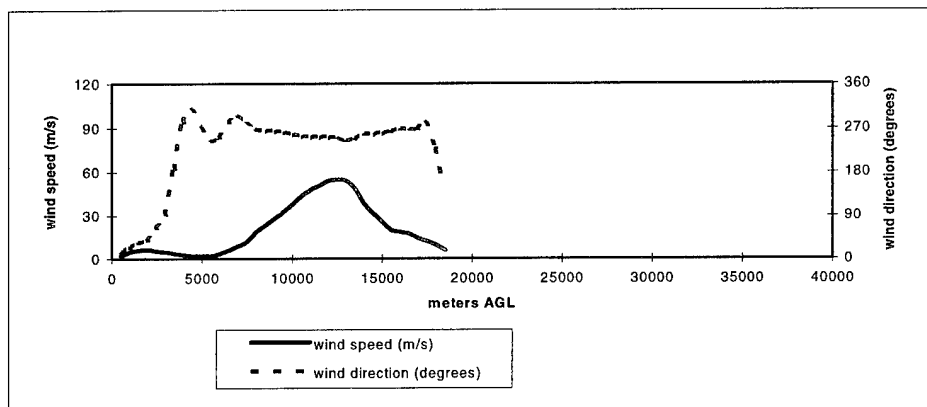


Figure 405. Cheju 920706-1200

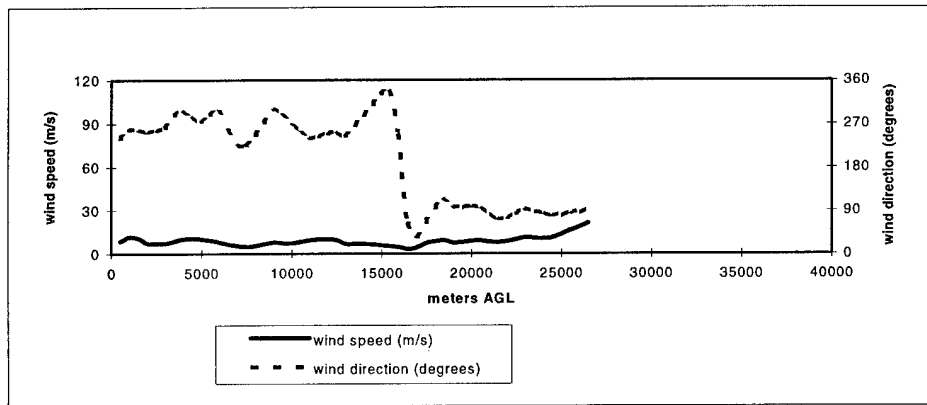


Figure 406. Cheju 920723-0000



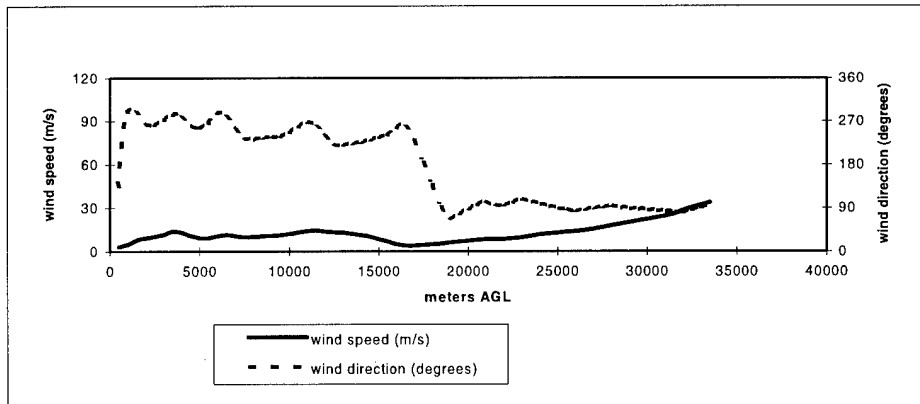


Figure 407. Cheju 920731-1200

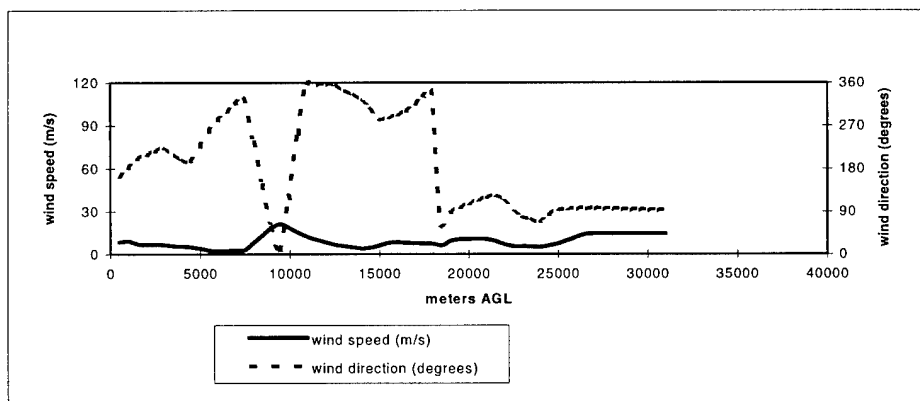


Figure 408. Cheju 920806-1200

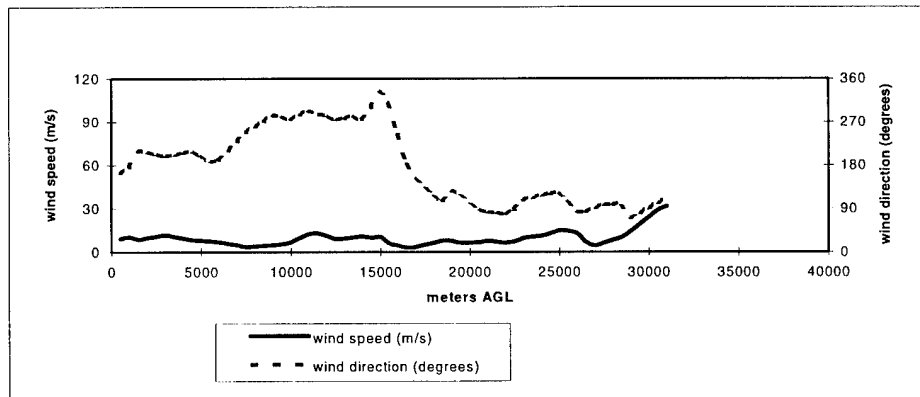


Figure 409. Cheju 920807-0000

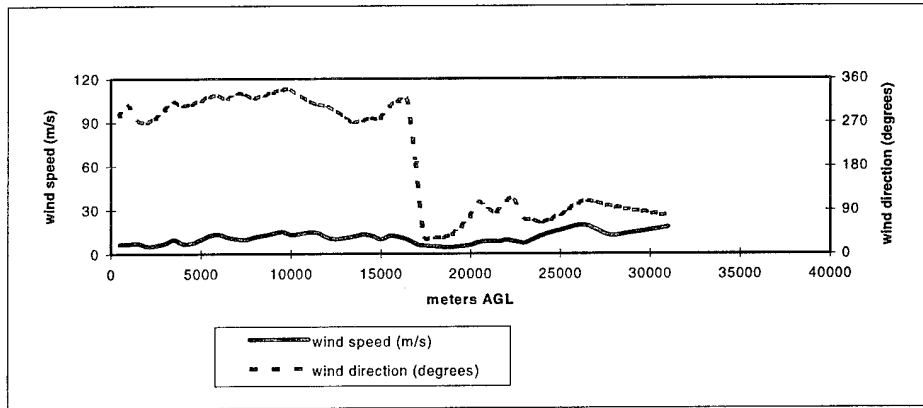


Figure 410. Cheju 920808-1200

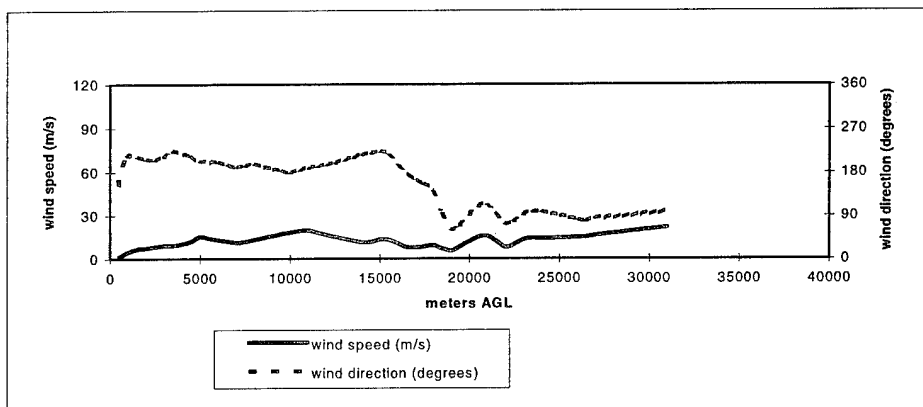


Figure 411. Cheju 920816-0000

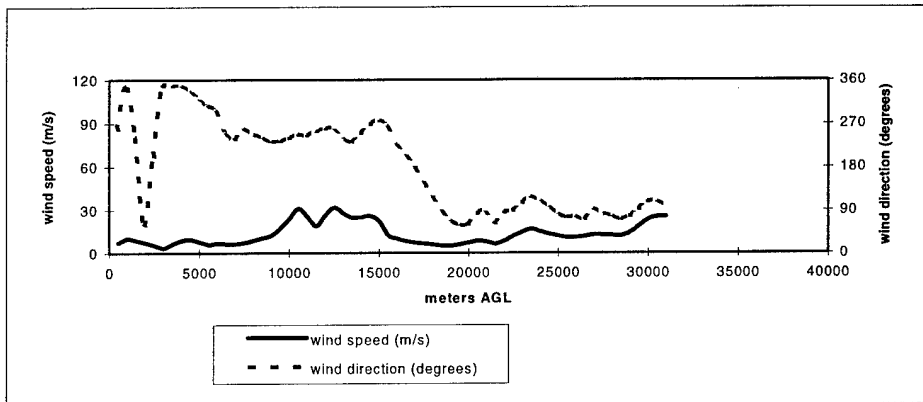
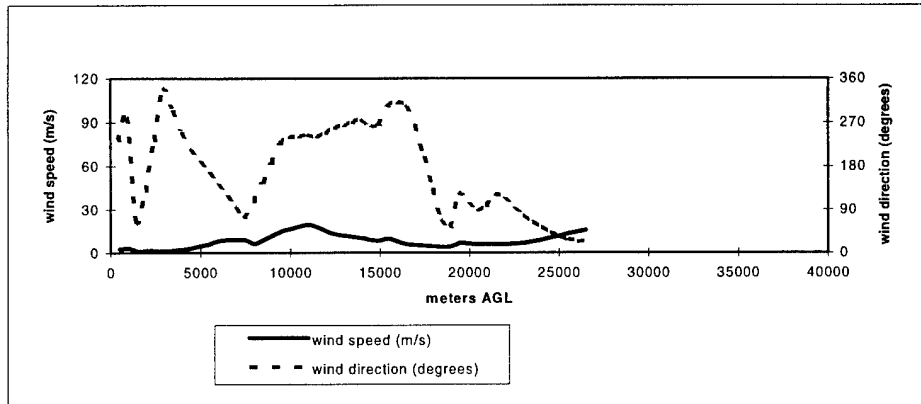
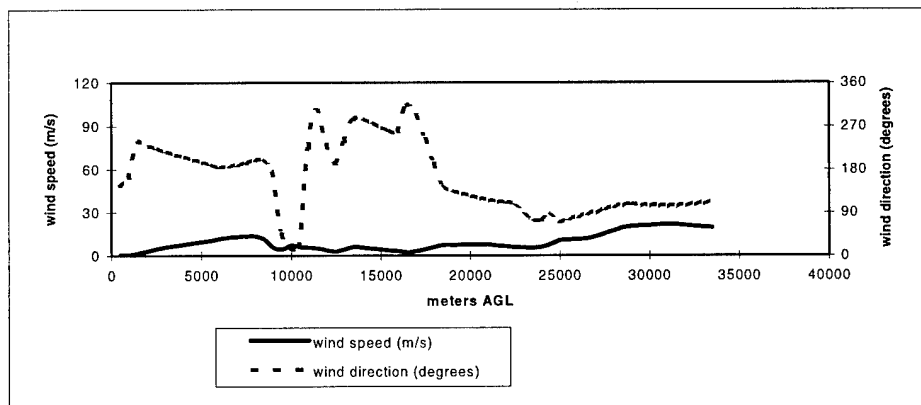


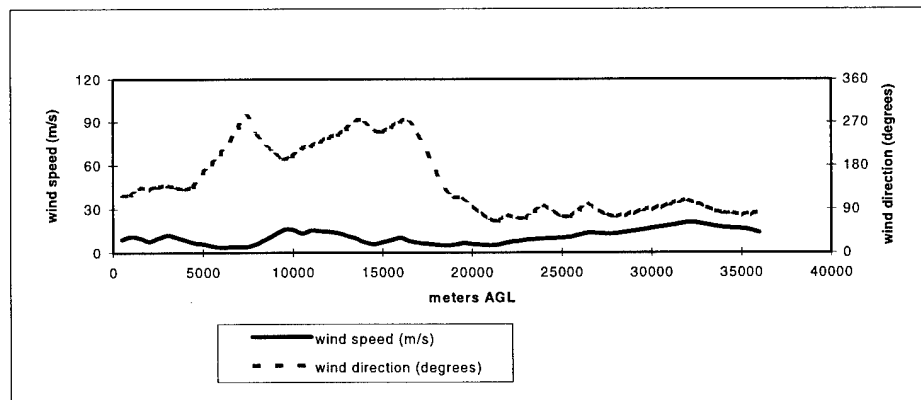
Figure 412. Cheju 920819-0000



**Figure 413. Cheju 920820-1200**



**Figure 414. Cheju 920822-0000**



**Figure 415. Cheju 920828-1200**

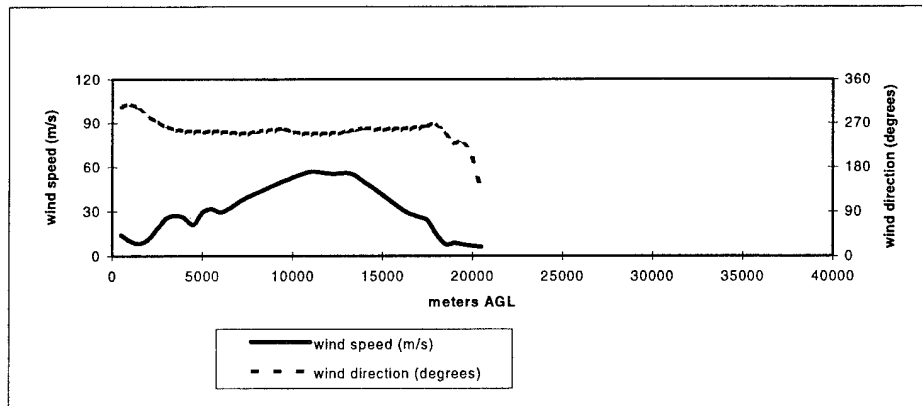


Figure 416. Cheju 920929-0000

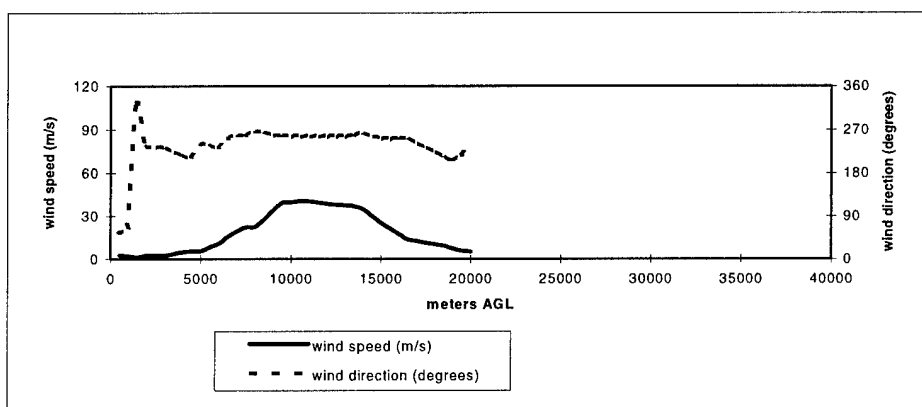


Figure 417. Cheju 920930-1200

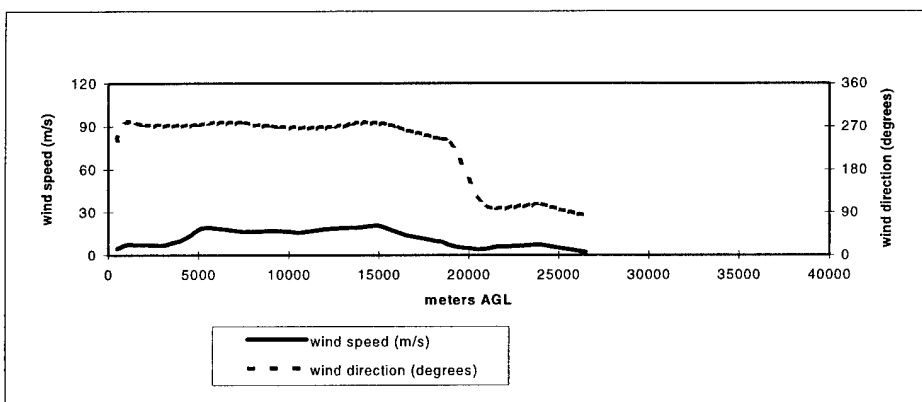


Figure 418. Cheju 921004-0000

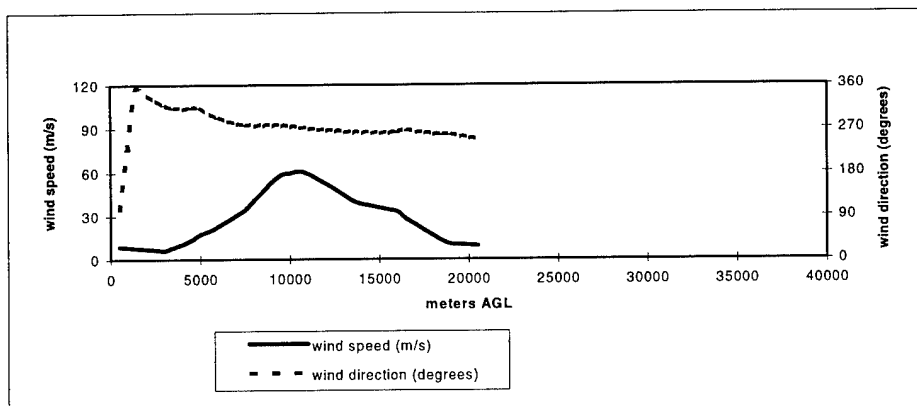


Figure 419. Cheju 921026-1200

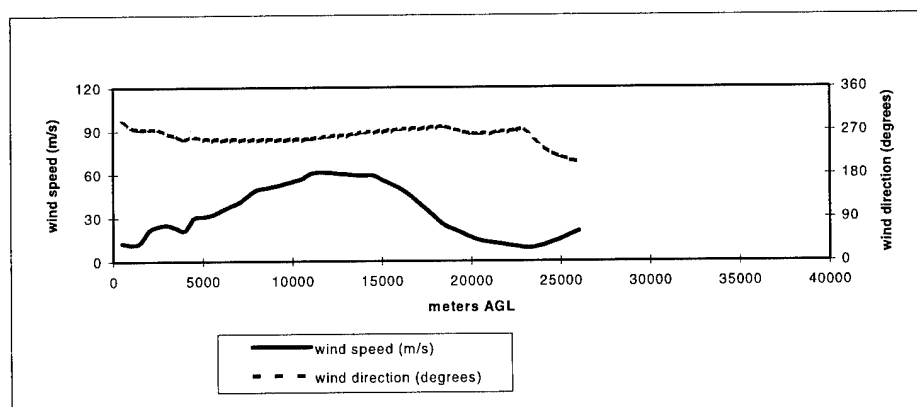


Figure 420. Cheju 921228-0000

## 6.8 Kwanju, South Korea

**Table 15. Table of Spread Distances (m), Kwanju, South Korea**

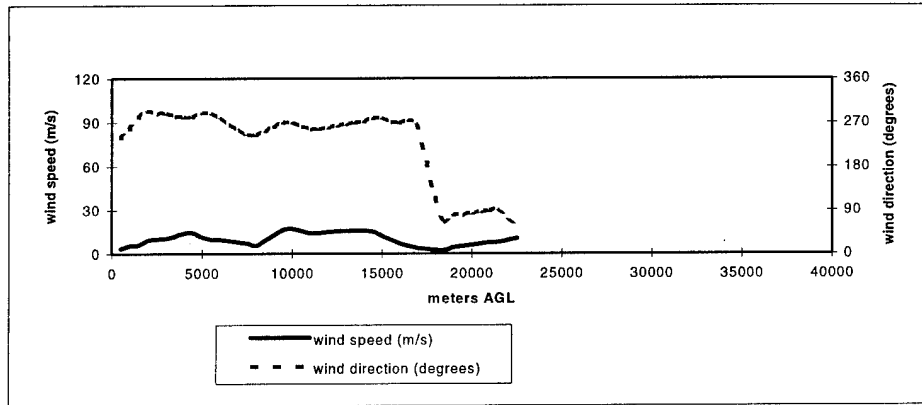
Order Statistic	Intercept Altitude					
	5 km			10 km		
	Spread Distance	Date/Time	Figure No.	Spread Distance	Date/Time	Figure No.
Minimum	693.	930806-0000	444	2225.	930722-1200	442
5th percentile	3963.	921006-0000	427	15227.	940822-0000	480
10th percentile	5804.	931115-0000	451	21579.	940830-0000	481
25th percentile	9650.	940616-0000	472	33281.	940611-1200	471
Median	15494.	940204-0000	462	50941.	931023-1200	450
75th percentile	22891.	920925-1200	425	72292.	940223-1200	466
90th percentile	31960.	930110-1200	435	94304.	931121-0000	452
95th percentile	36403.	940222-1200	465	107486.	921230-0000	434
Maximum	50471.	930223-0000	438	156795.	930223-0000	438
Number of Valid Profiles	1485			1454		

Order Statistic	Intercept Altitude					
	20 km			30 km		
	Spread Distance	Date/Time	Figure No.	Spread Distance	Date/Time	Figure No.
Minimum	9472.	940725-1200	477	15090.	930825-0000	447
5th percentile	32073.	940620-0000	473	42793.	930826-1200	448
10th percentile	47248.	930906-1200	449	56162.	920811-0000	422
25th percentile	80909.	930620-0000	440	88279.	930215-0000	437
Median	118471.	940610-0000	470	126597.	940531-1200	469
75th percentile	163639.	931230-0000	457	169238.	940211-0000	463
90th percentile	198092.	921124-0000	432	199403.	930410-0000	439
95th percentile	218409.	940108-0000	459	219224.	921209-0000	433
Maximum	281643.	931216-1200	454	280640.	931126-1200	453
Number of Valid Profiles	1081			320		

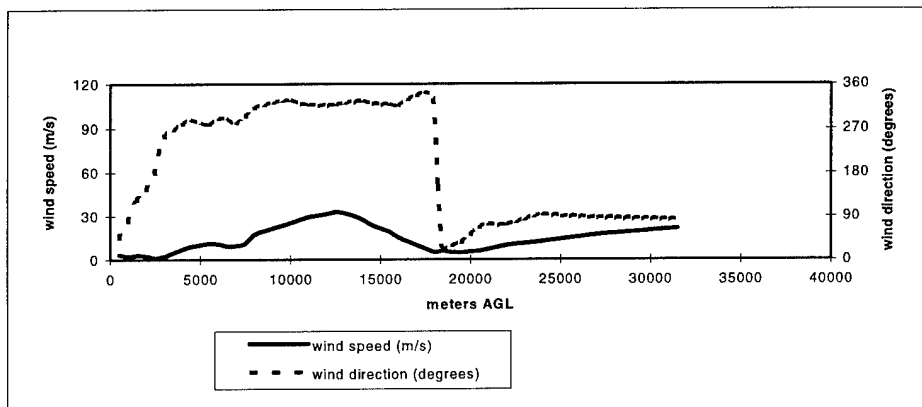
**Table 16. Table of Travel Distances (m), Kwanju, South Korea**

Order Statistic	Intercept Altitude					
	5 km			10 km		
	Travel Distance	Date/Time	Figure No.	Travel Distance	Date/Time	Figure No.
Minimum	251.	930806-0000	444	487.	930722-1200	442
5th percentile	1356.	920821-0000	424	4904.	940721-0000	476
10th percentile	1997.	940818-1200	479	6926.	940711-0000	475
25th percentile	3329.	930807-1200	445	10475.	921118-1200	430
Median	5320.	920723-0000	421	16145.	920927-0000	426
75th percentile	7872.	920819-0000	423	22904.	930629-1200	441
90th percentile	10916.	921120-0000	431	29934.	931121-0000	452
95th percentile	12374.	940117-1200	460	33978.	940202-0000	461
Maximum	17136.	930223-0000	438	49565.	930223-0000	438
Number of Valid Profiles	1485			1454		

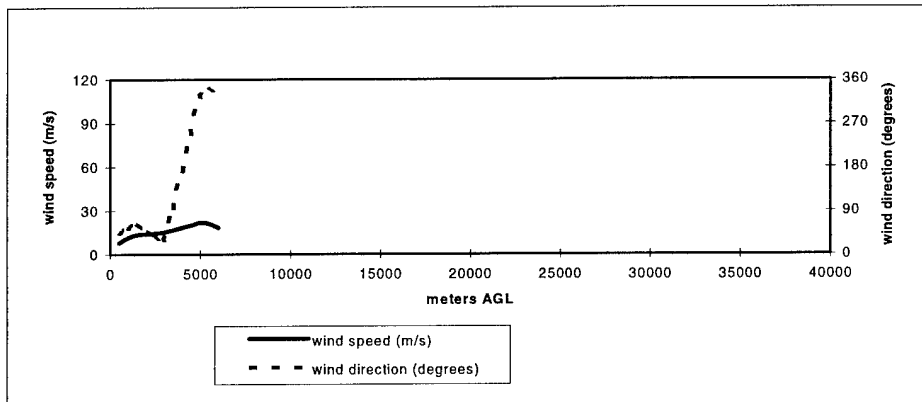
Order Statistic	Intercept Altitude					
	20 km			30 km		
	Travel Distance	Date/Time	Figure No.	Travel Distance	Date/Time	Figure No.
Minimum	3179.	940725-1200	477	5577.	930825-0000	447
5th percentile	9665.	930724-1200	443	13037.	930826-1200	448
10th percentile	13669.	930809-1800	446	16809.	940817-0000	478
25th percentile	22782.	940624-0000	474	25533.	921013-1200	428
Median	33059.	920927-0000	426	34349.	940321-0000	468
75th percentile	45181.	931225-0000	455	45093.	940318-0000	467
90th percentile	55501.	940216-1200	464	54348.	921113-0000	429
95th percentile	61408.	931227-1200	456	60983.	930208-0000	436
Maximum	79443.	940106-0000	458	78477.	931126-1200	453
Number of Valid Profiles	1081			320		



**Figure 421. Kwanju 920723-0000**



**Figure 422. Kwanju 920811-0000**



**Figure 423. Kwanju 920819-0000**



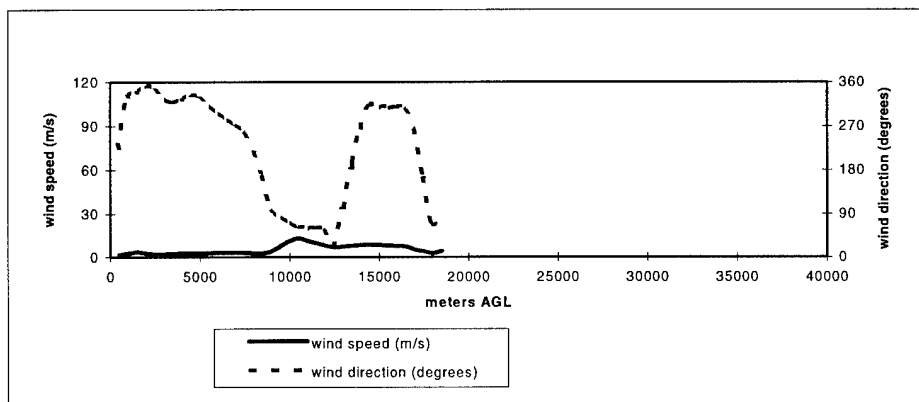


Figure 424. Kwanju 920821-0000

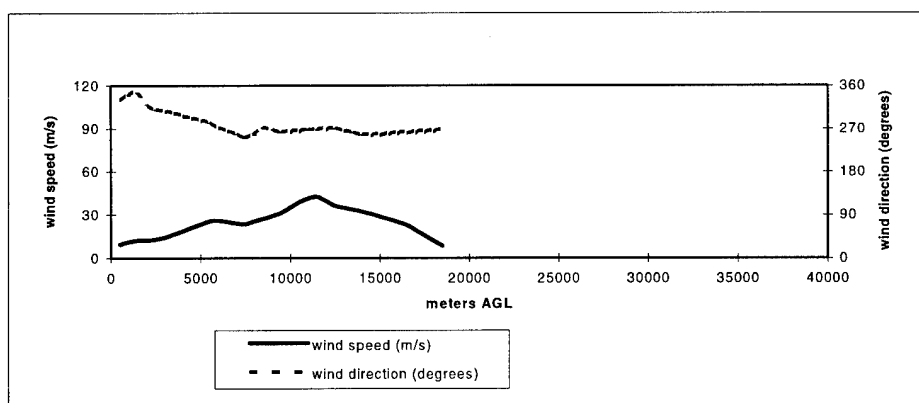


Figure 425. Kwanju 920925-1200

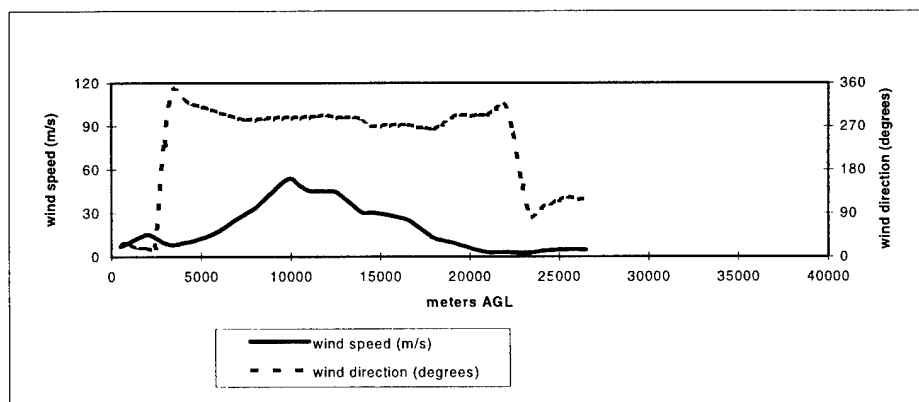
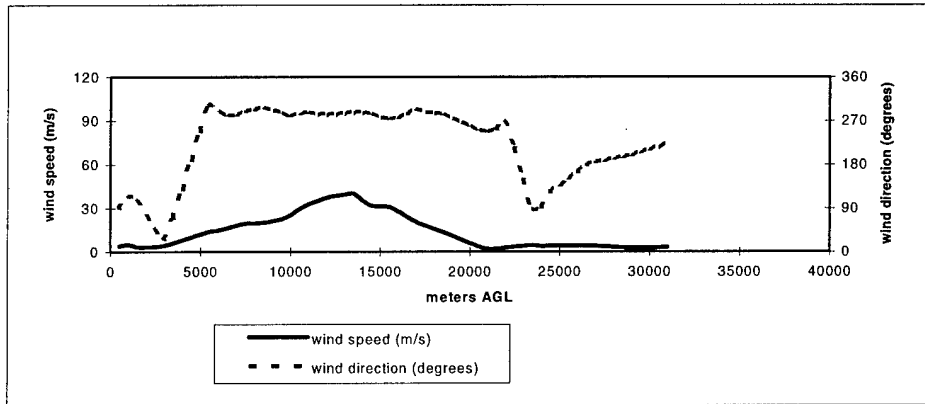
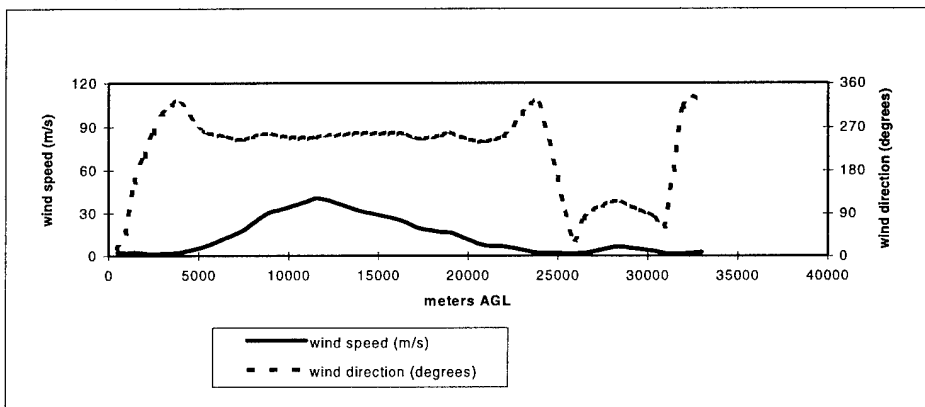


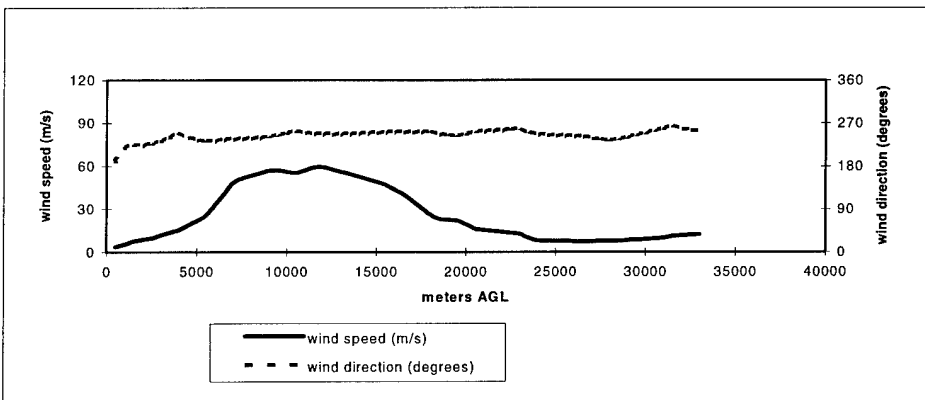
Figure 426. Kwanju 920927-0000



**Figure 427. Kwanju 921006-0000**



**Figure 428. Kwanju 921013-1200**



**Figure 429. Kwanju 921113-0000**

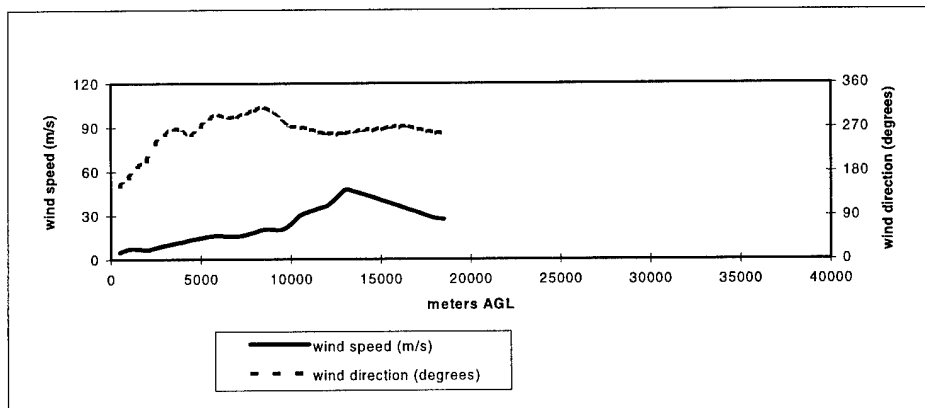


Figure 430. Kwanju 921118-1200

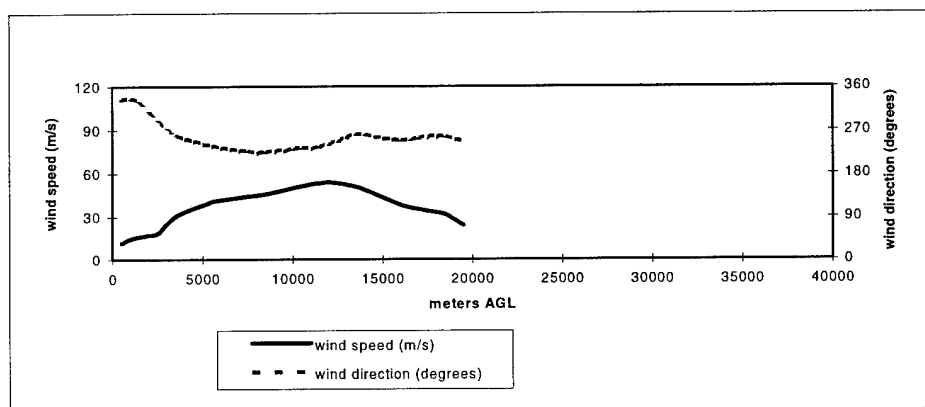


Figure 431. Kwanju 921120-0000

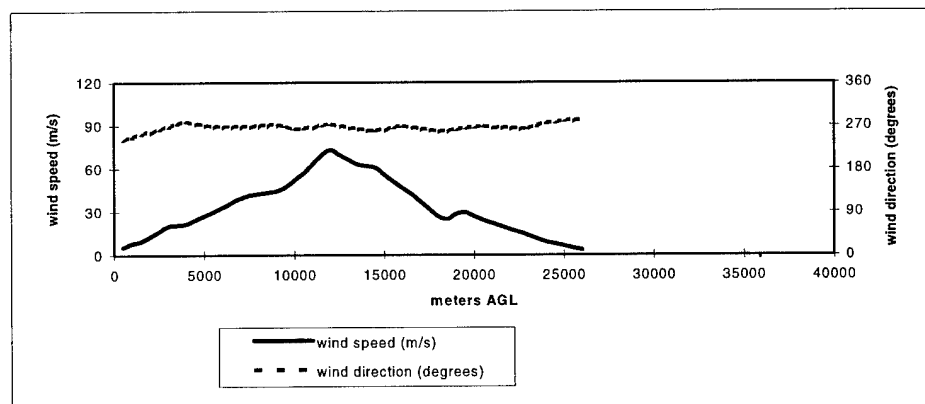


Figure 432. Kwanju 921124-0000

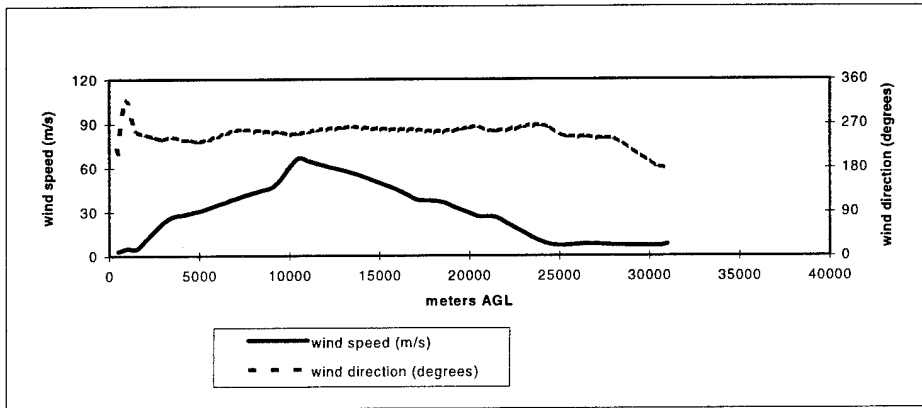


Figure 433. Kwanju 921209-0000

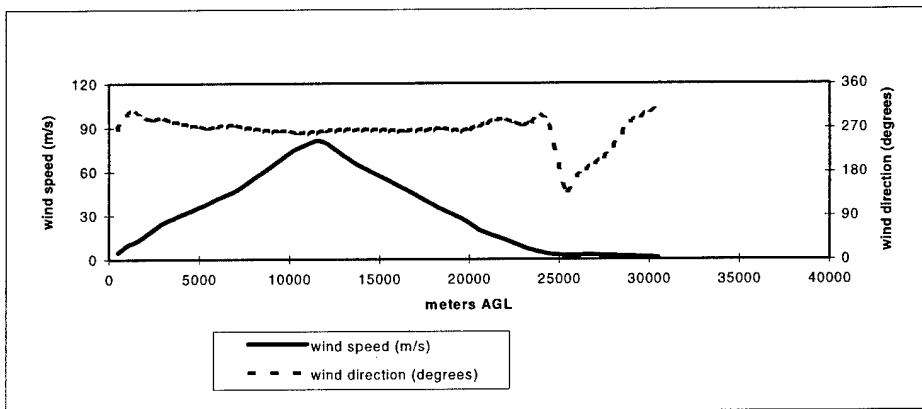


Figure 434. Kwanju 921230-0000

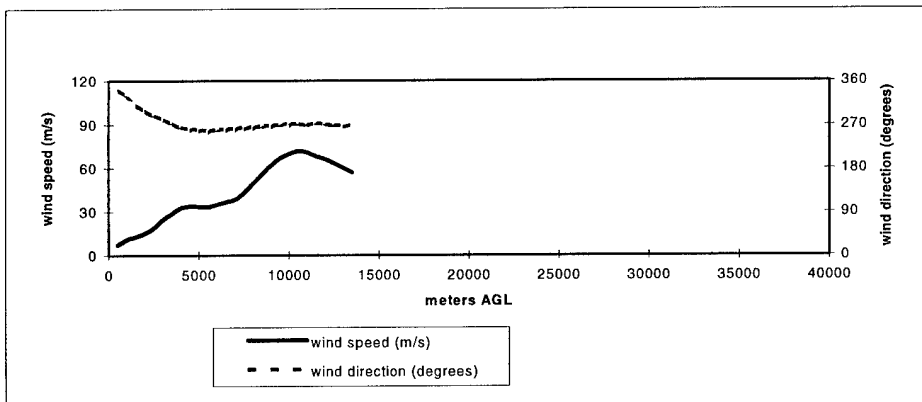


Figure 435. Kwanju 930110-1200

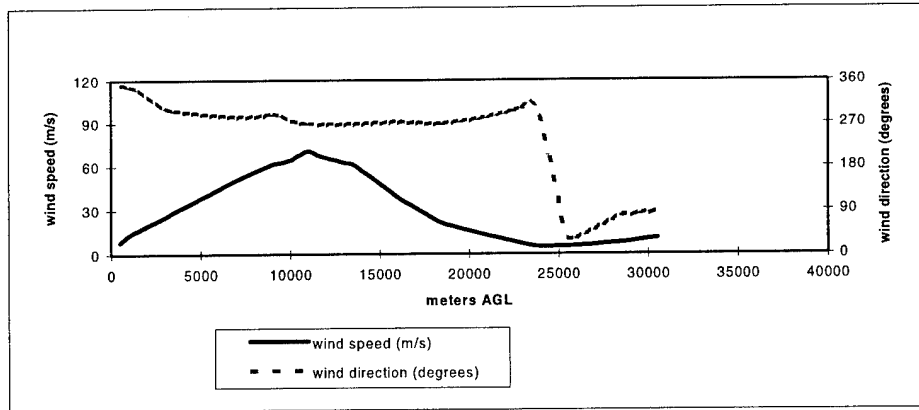


Figure 436. Kwanju 930208-0000

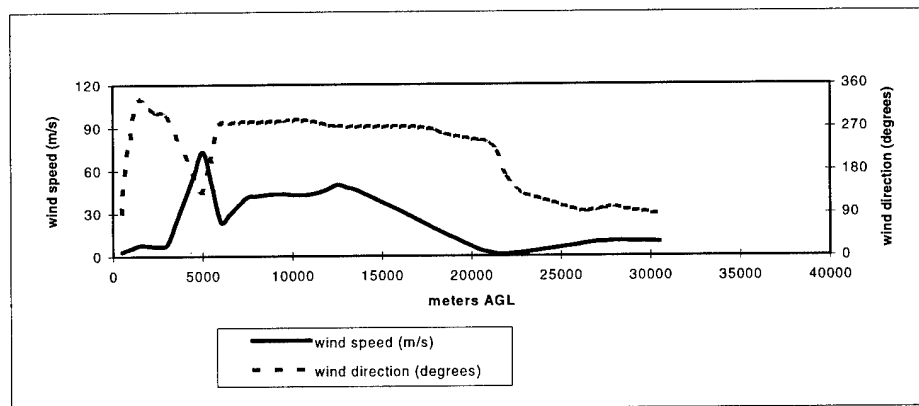


Figure 437. Kwanju 930215-0000

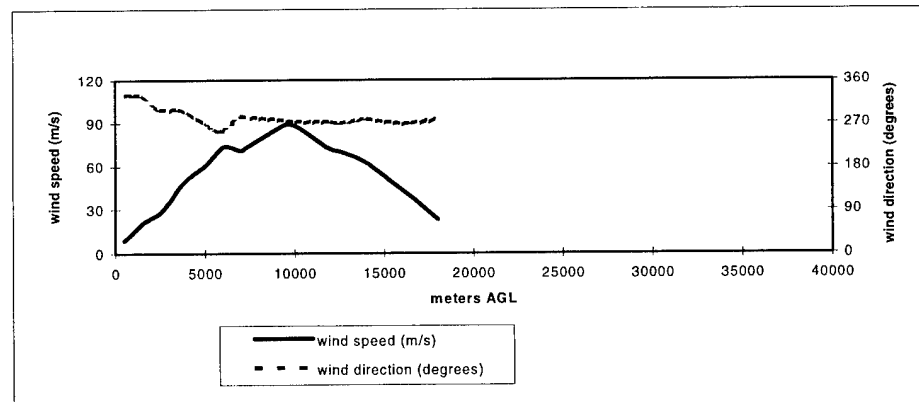


Figure 438. Kwanju 930223-0000

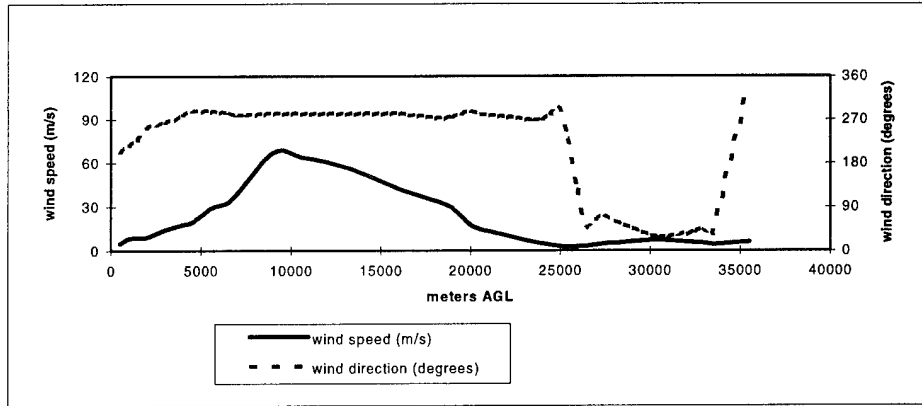


Figure 439. Kwanju 930410-0000

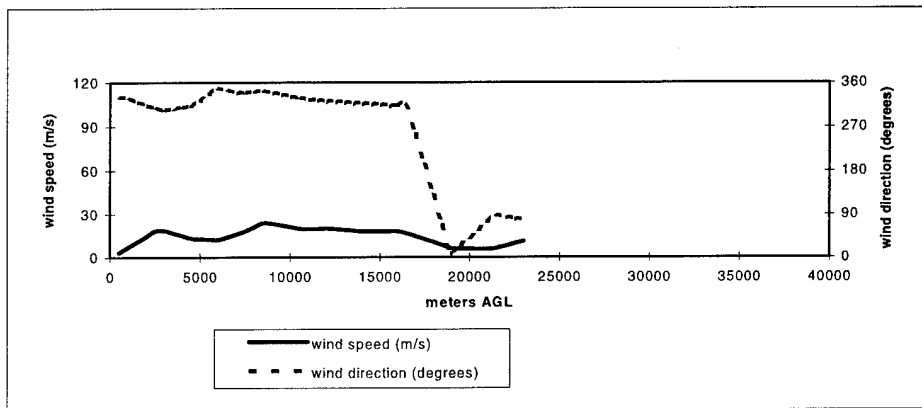


Figure 440. Kwanju 930620-0000

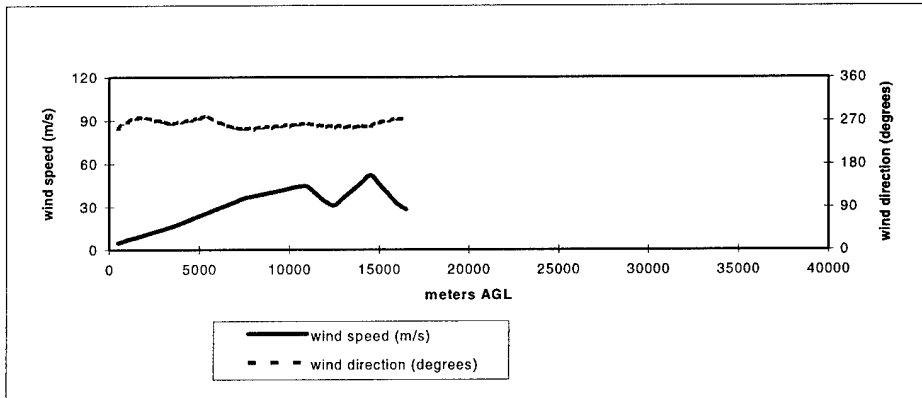


Figure 441. Kwanju 930629-1200

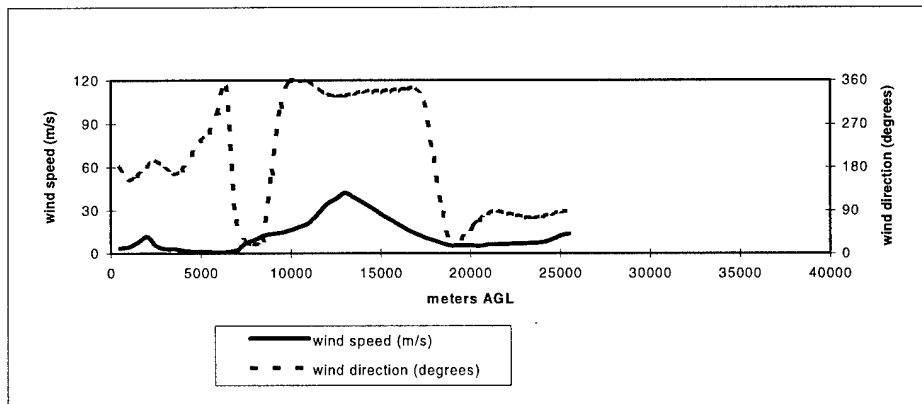


Figure 442. Kwanju 930722-1200

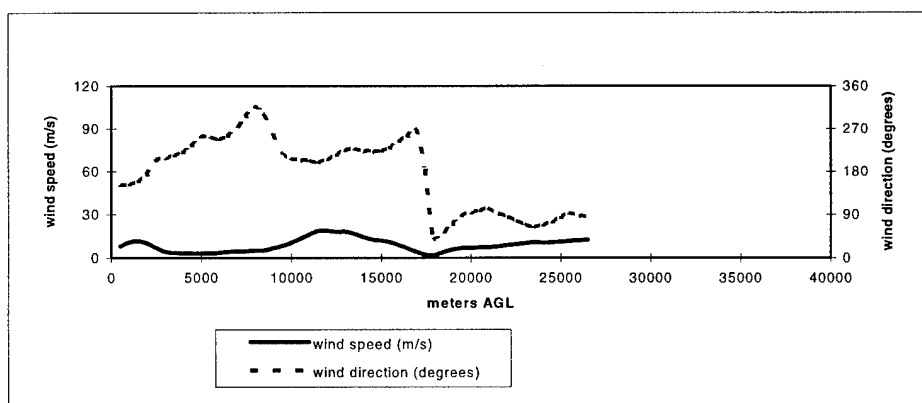


Figure 443. Kwanju 930724-1200

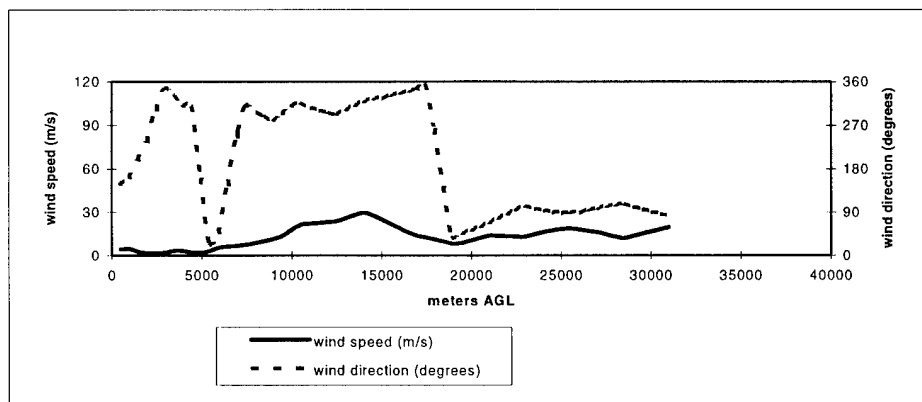


Figure 444. Kwanju 930806-0000

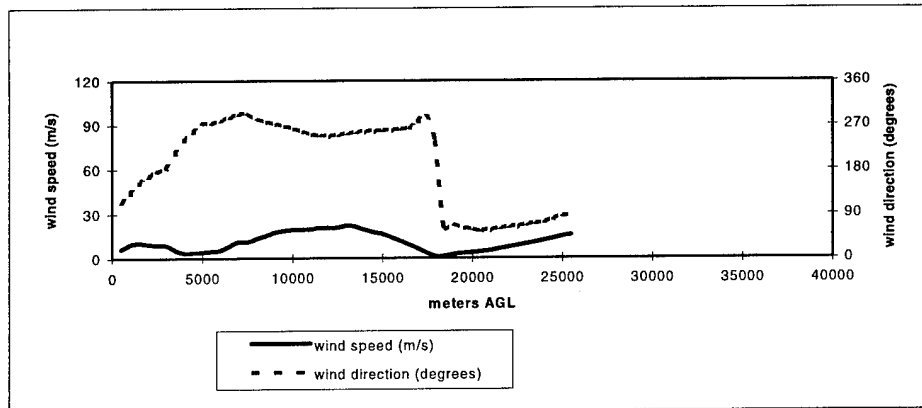


Figure 445. Kwanju 930807-1200

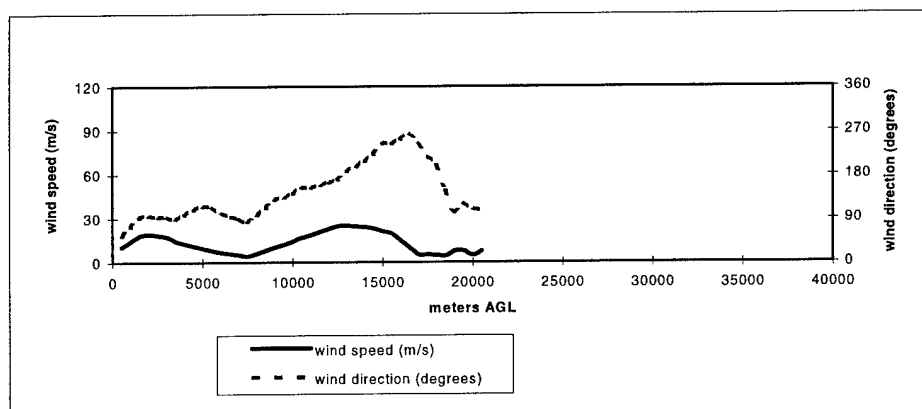


Figure 446. Kwanju 930809-1800

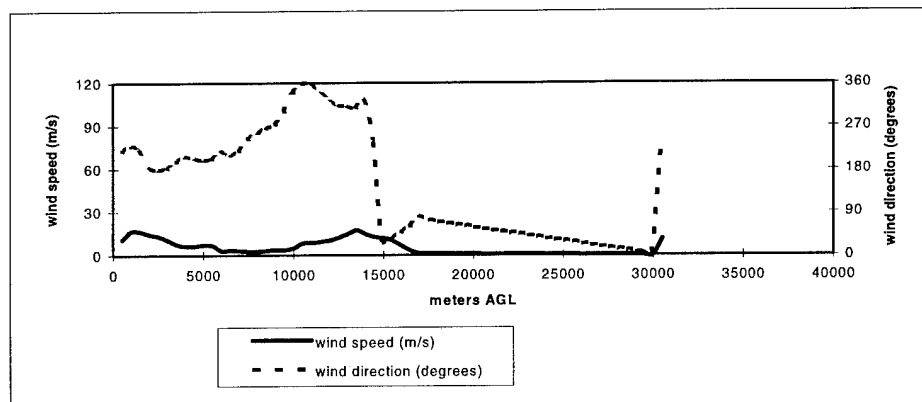
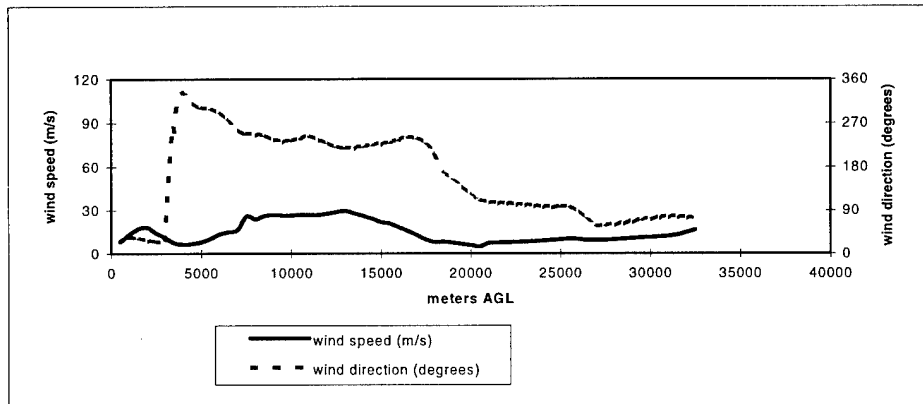
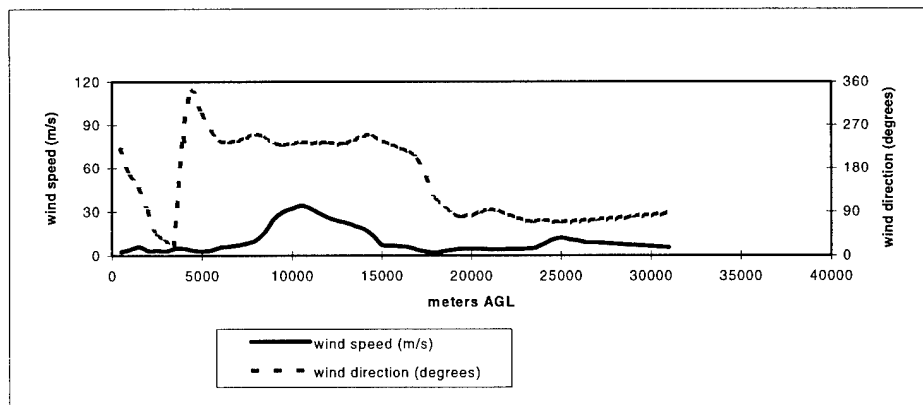


Figure 447. Kwanju 930825-0000

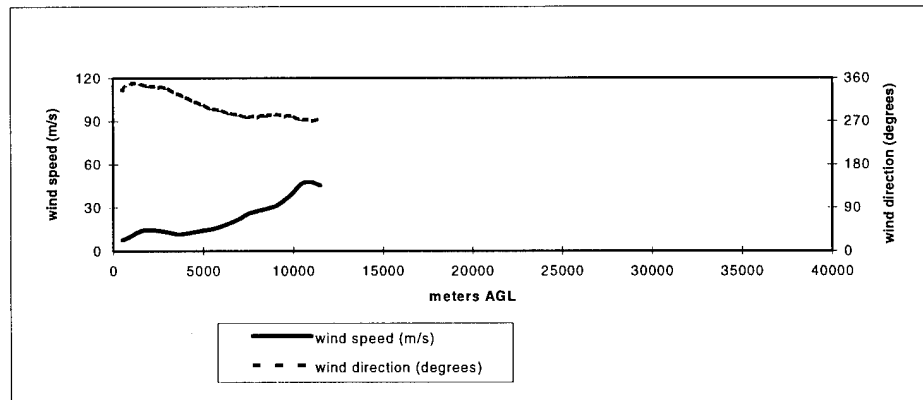




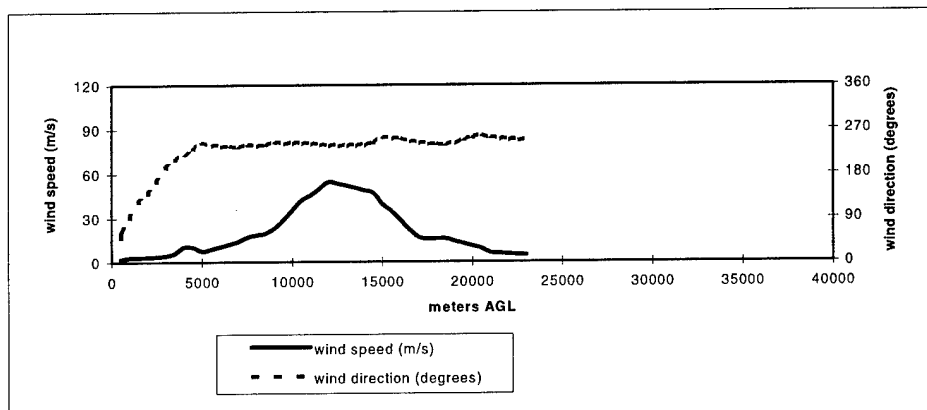
**Figure 448. Kwanju 930826-1200**



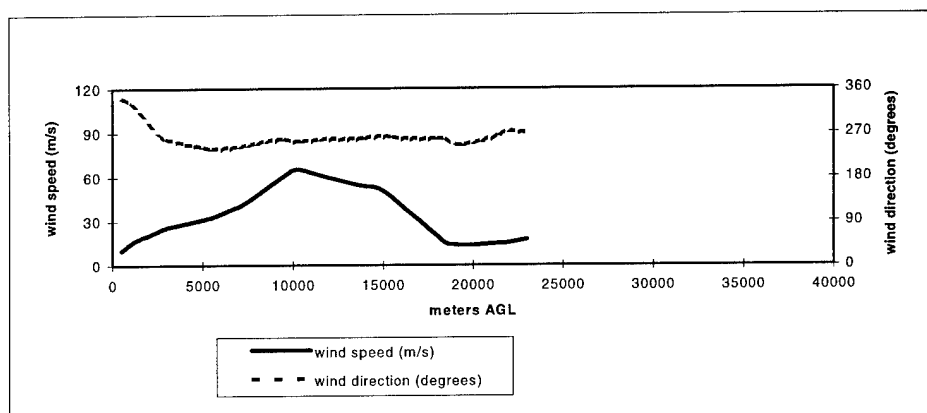
**Figure 449. Kwanju 930906-1200**



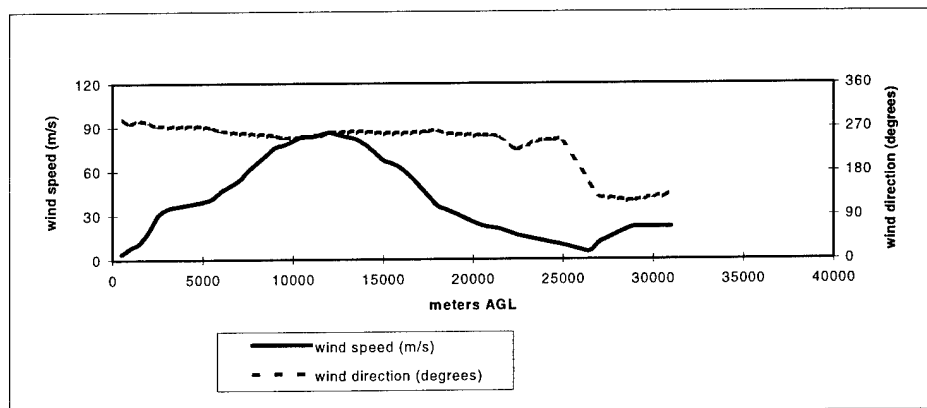
**Figure 450. Kwanju 931023-1200**



**Figure 451. Kwanju 931115-0000**



**Figure 452. Kwanju 931121-0000**



**Figure 453. Kwanju 931126-1200**

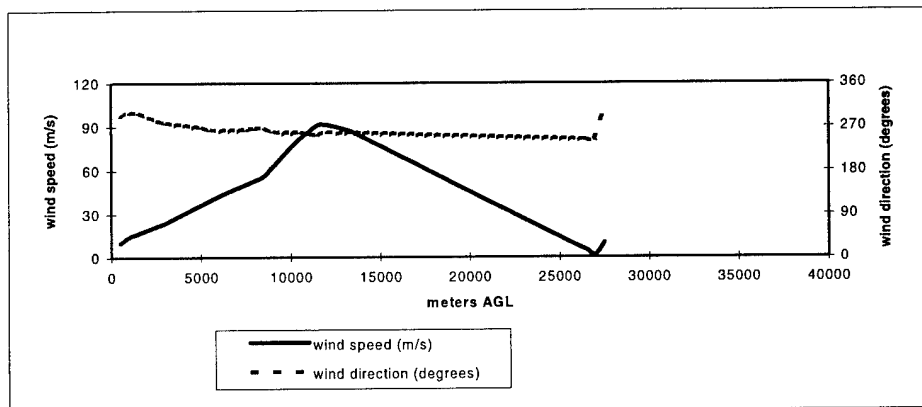


Figure 454. Kwanju 931216-1200

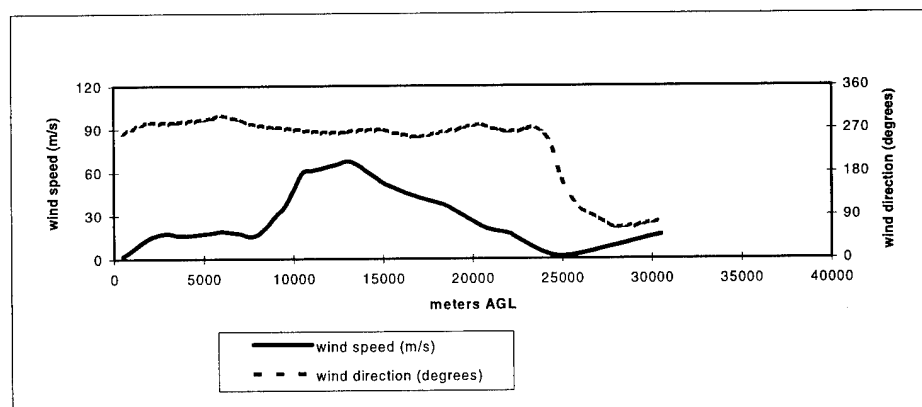


Figure 455. Kwanju 931225-0000

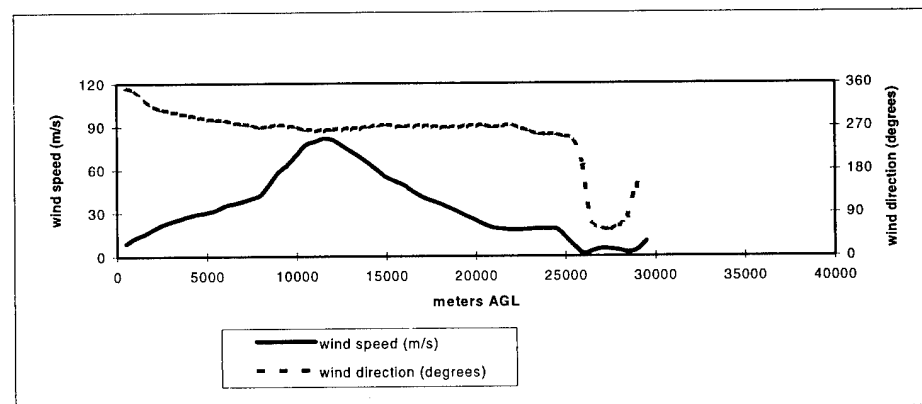
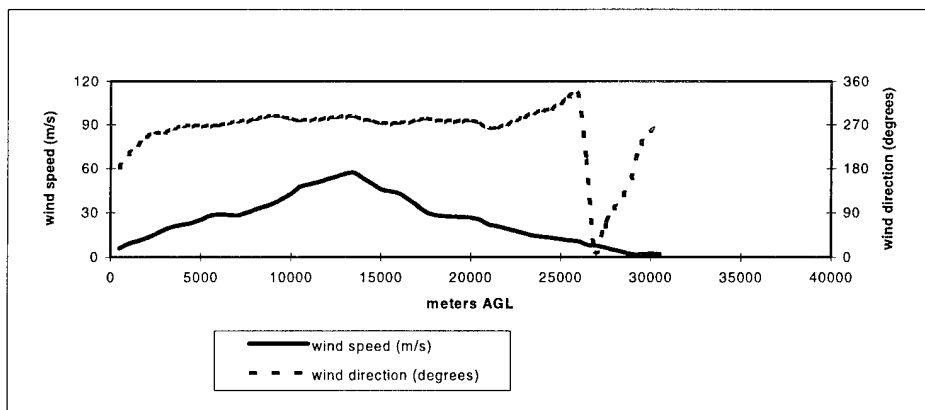
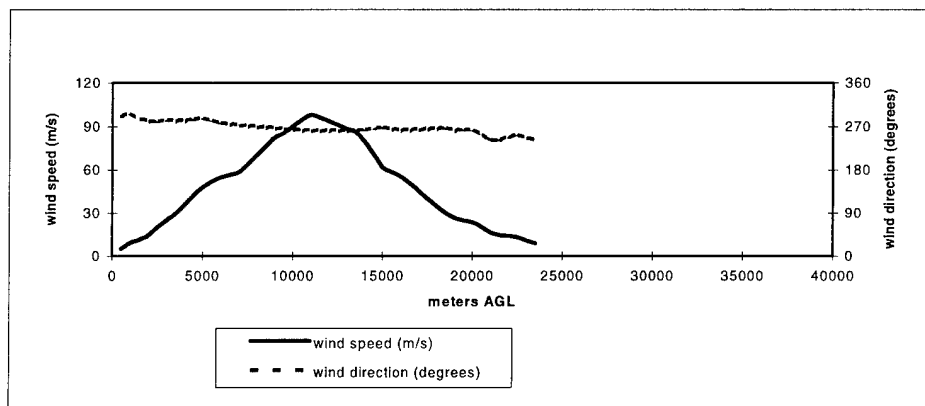


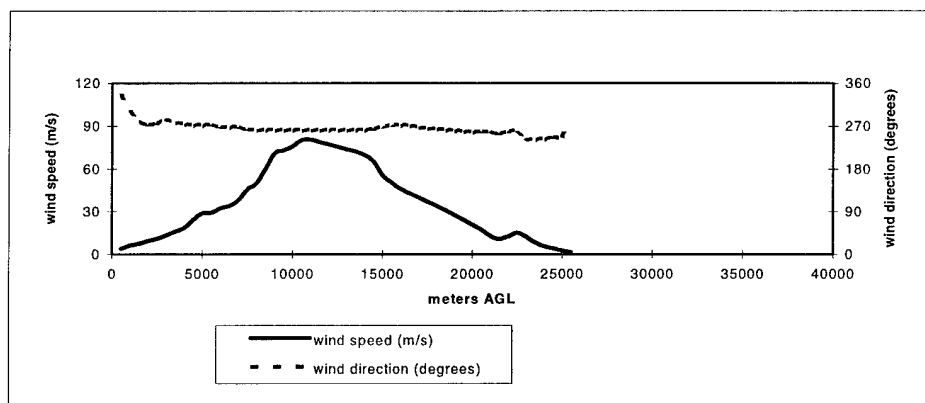
Figure 456. Kwanju 931227-1200



**Figure 457. Kwanju 931230-0000**



**Figure 458. Kwanju 940106-0000**



**Figure 459. Kwanju 940108-0000**

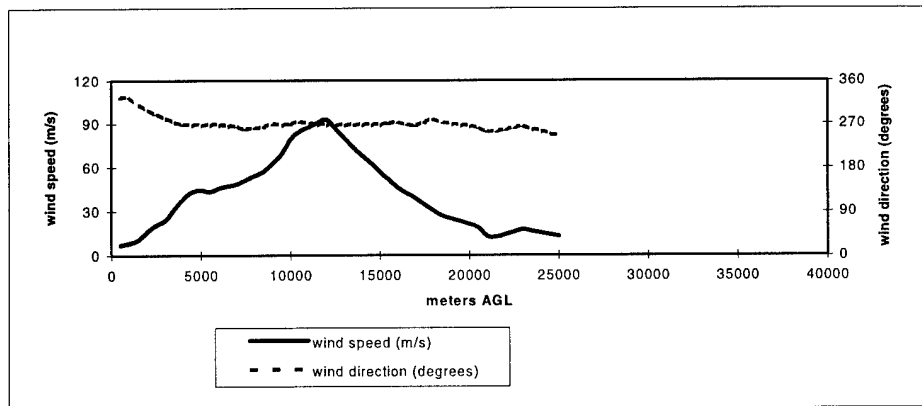


Figure 460. Kwanju 940117-1200

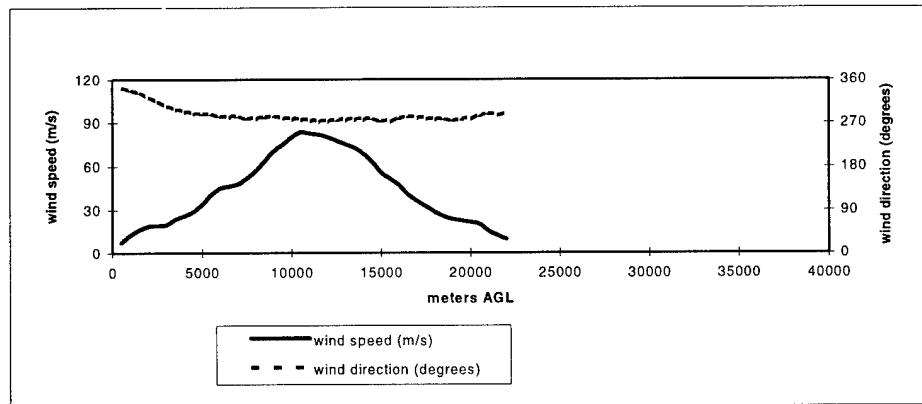


Figure 461. Kwanju 940202-0000

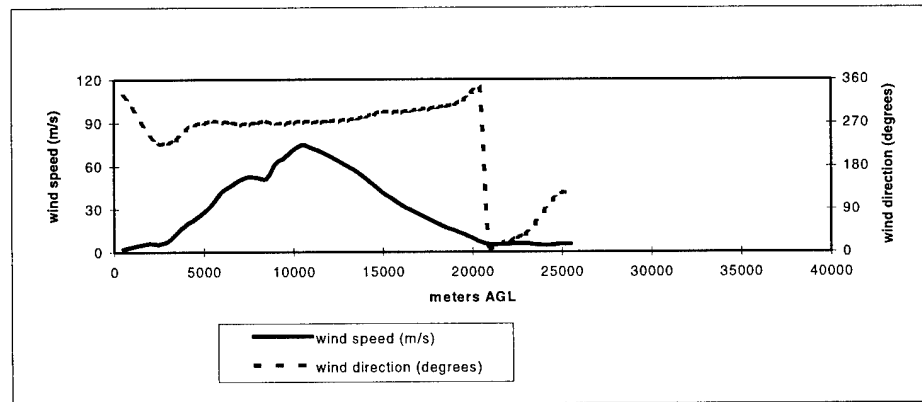


Figure 462. Kwanju 940204-0000

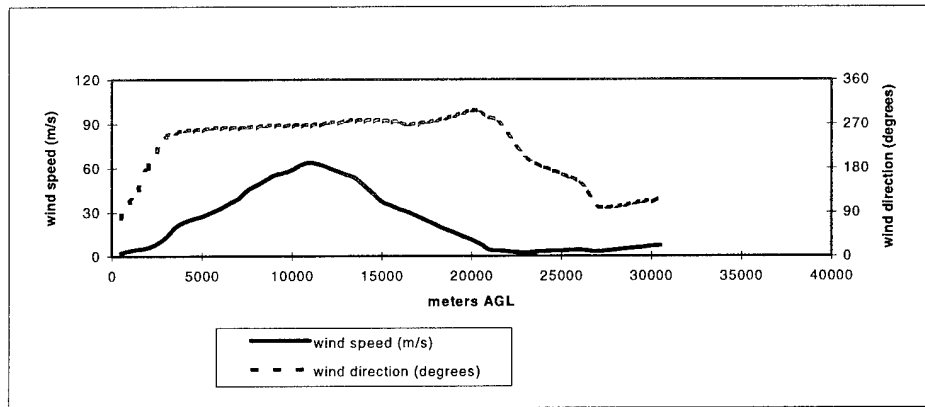


Figure 463. Kwanju 940211-0000

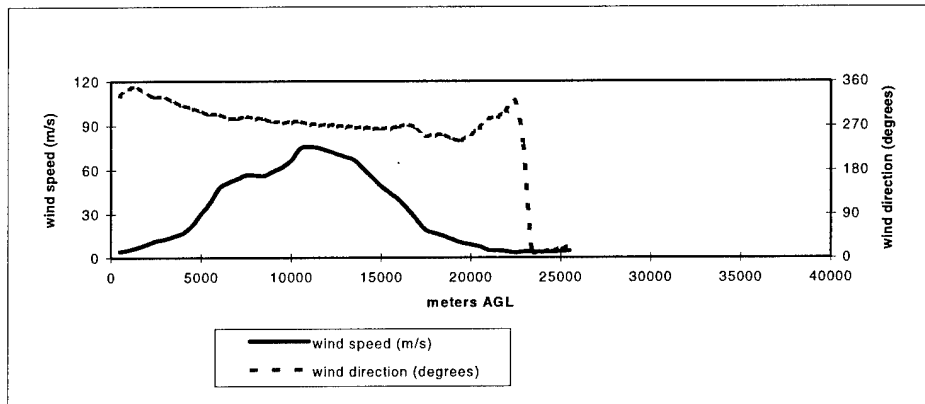


Figure 464. Kwanju 940216-1200

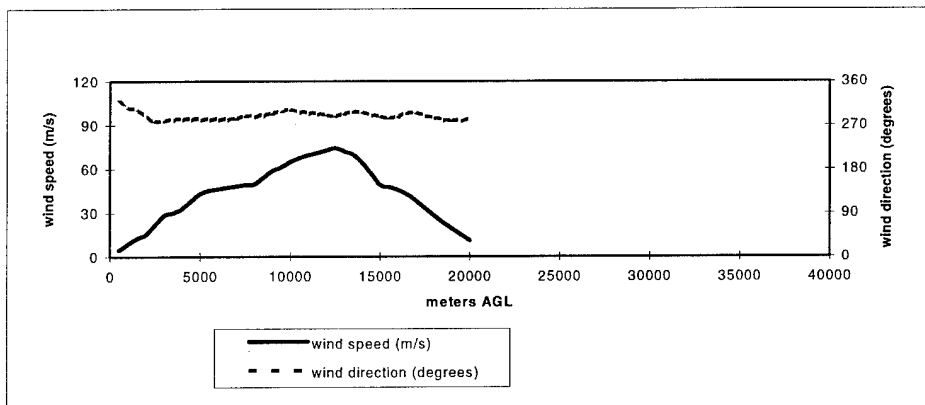


Figure 465. Kwanju 940222-1200

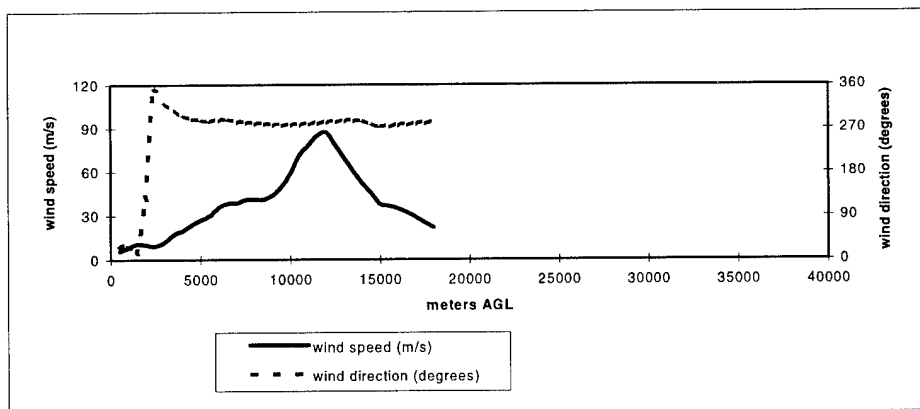


Figure 466. Kwanju 940223-1200

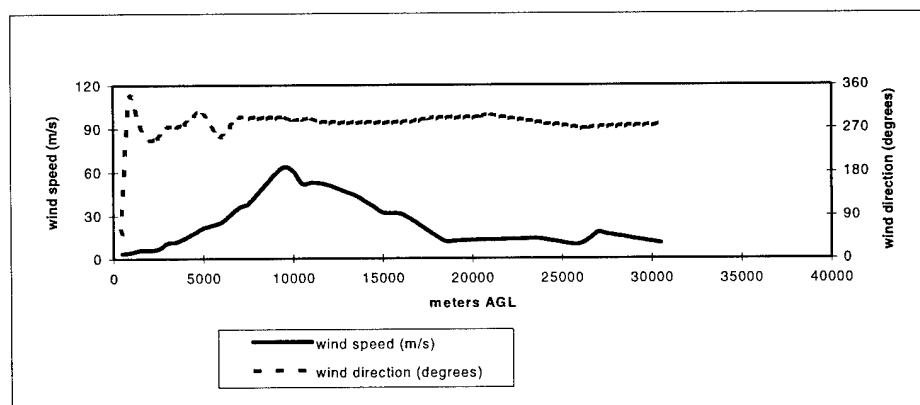


Figure 467. Kwanju 940318-0000

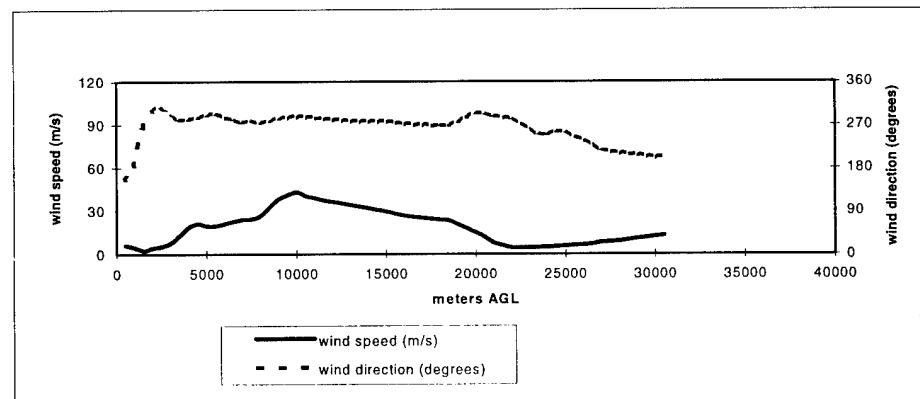
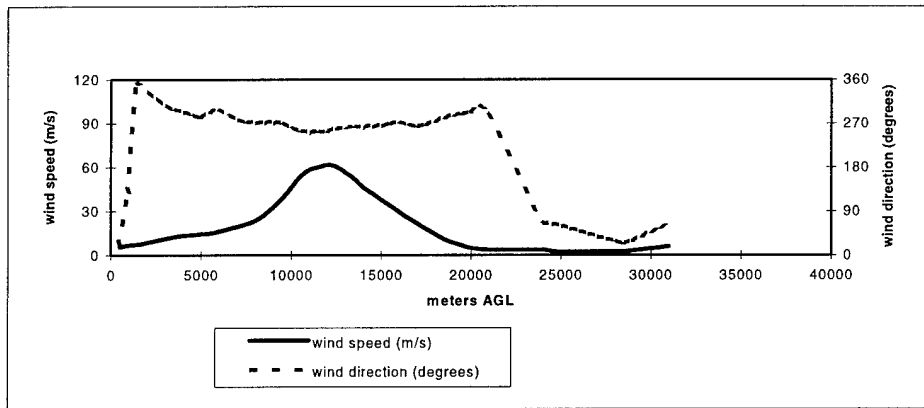
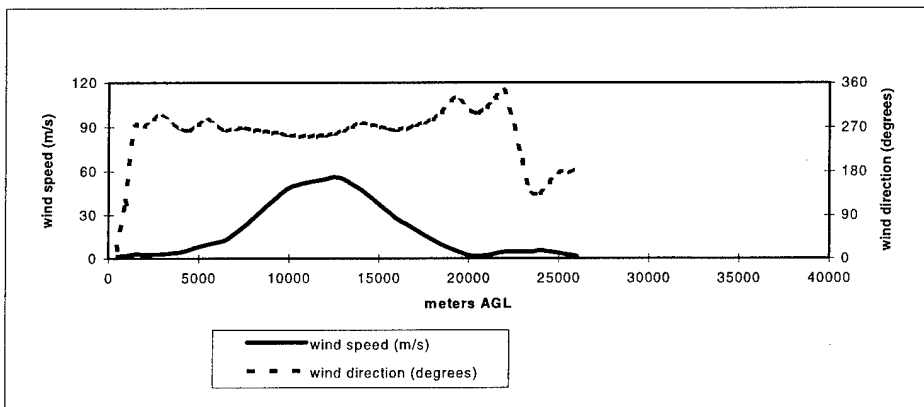


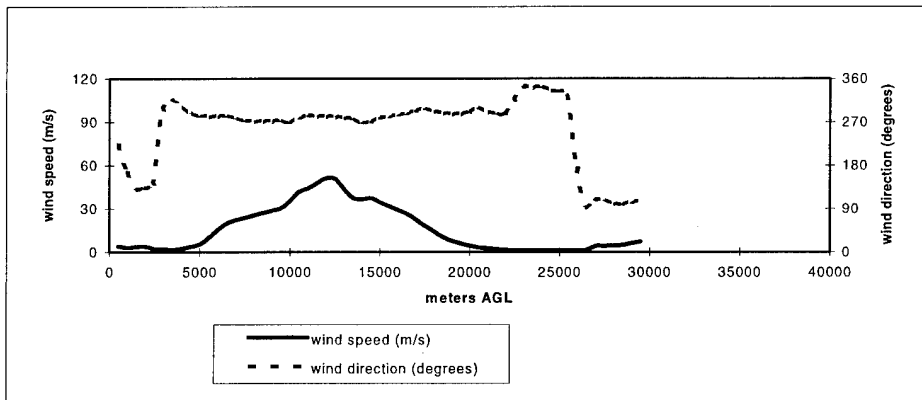
Figure 468. Kwanju 940321-0000



**Figure 469. Kwanju 940531-1200**



**Figure 470. Kwanju 940610-0000**



**Figure 471. Kwanju 940611-1200**



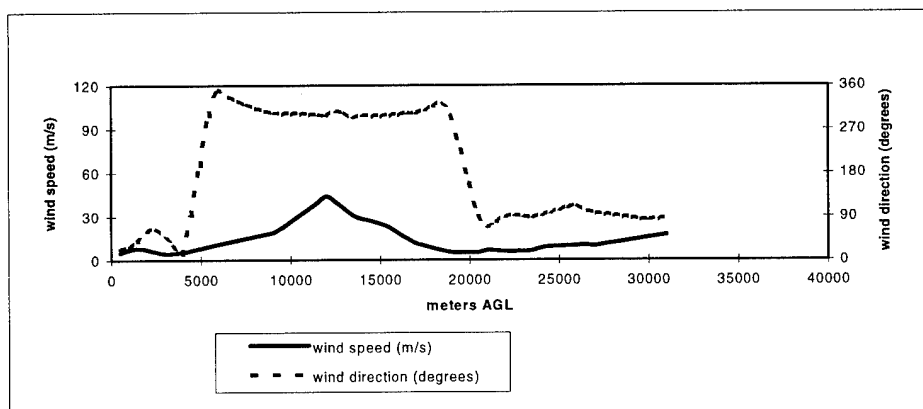


Figure 472. Kwanju 940616-0000

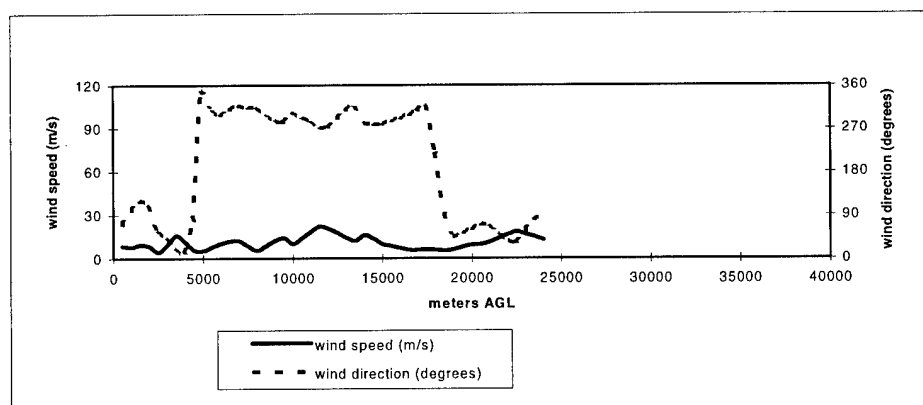


Figure 473. Kwanju 940620-0000

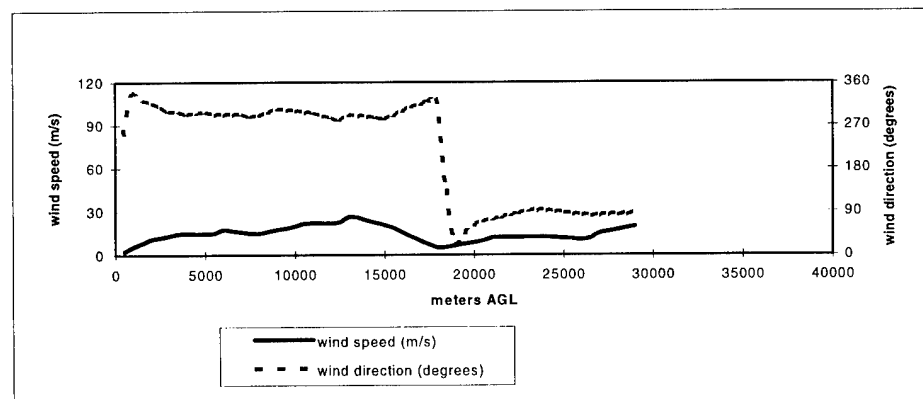


Figure 474. Kwanju 940624-0000

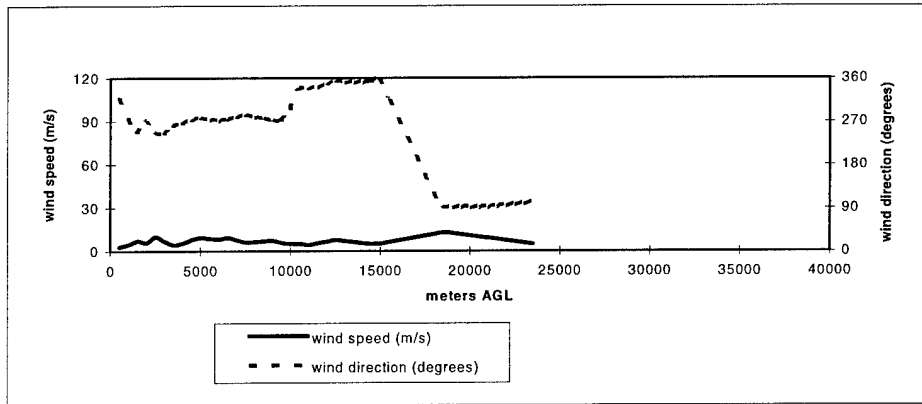


Figure 475. Kwanju 940711-0000

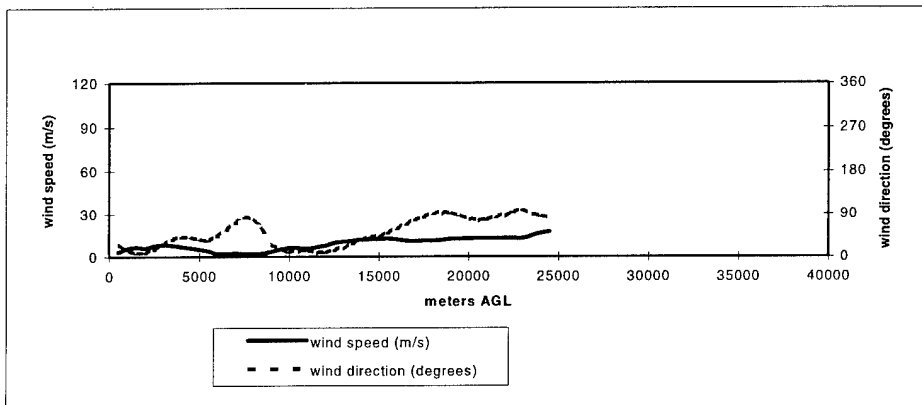


Figure 476. Kwanju 940721-0000

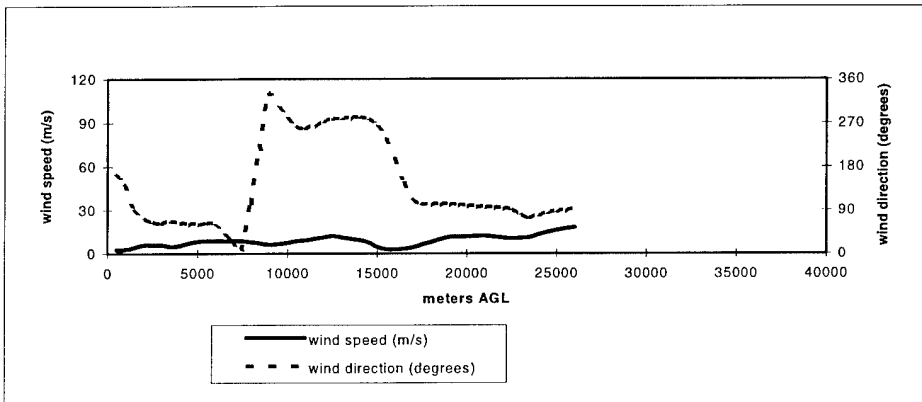
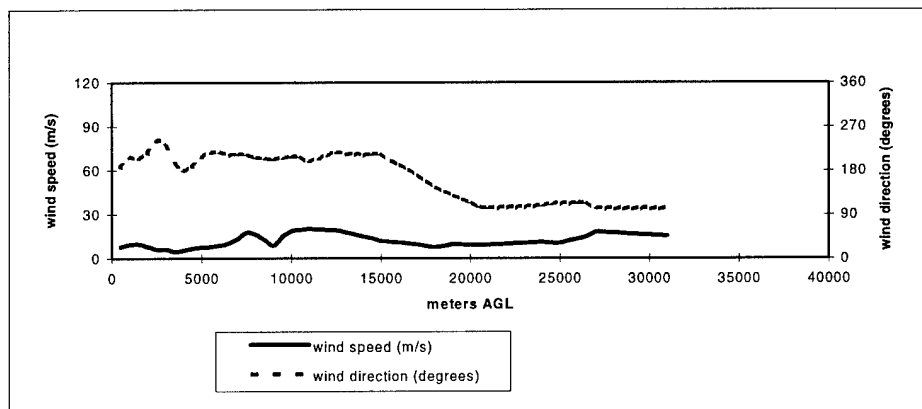
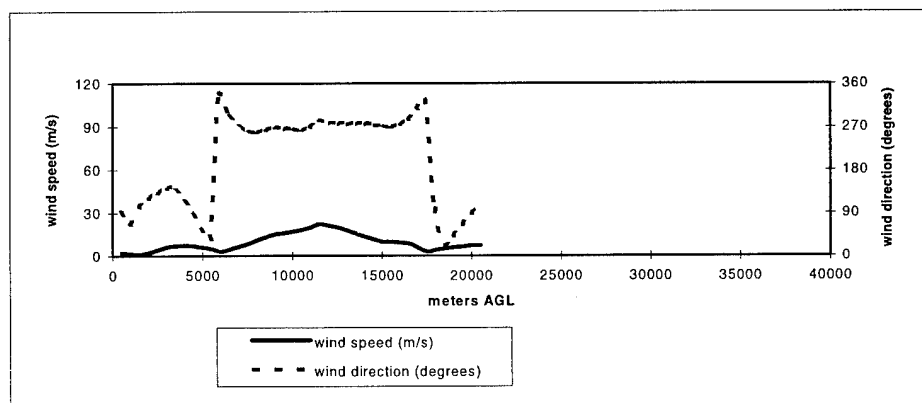


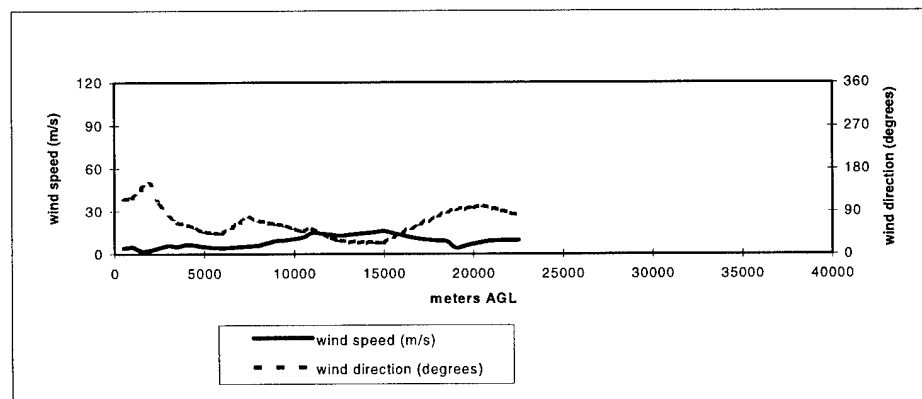
Figure 477. Kwanju 940725-1200



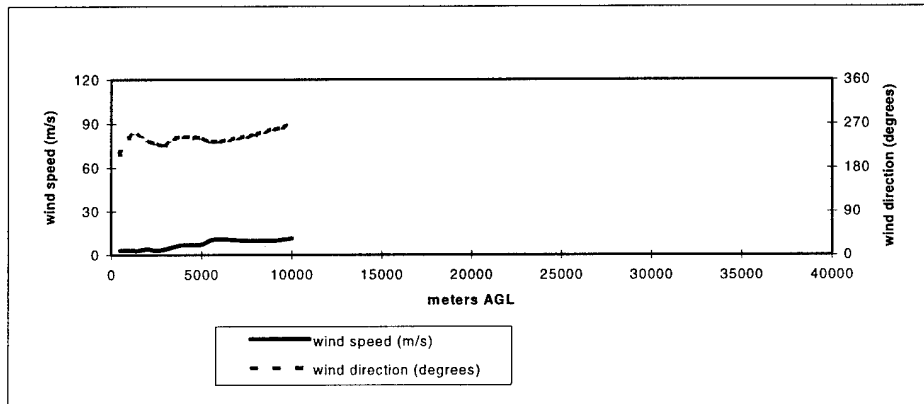
**Figure 478. Kwanju 940817-0000**



**Figure 479. Kwanju 940818-1200**



**Figure 480. Kwanju 940822-0000**



**Figure 481. Kwanju 940830-0000**

## 6.9 Osan, South Korea

**Table 17. Table of Spread Distances (m), Osan, South Korea**

Order Statistic	Intercept Altitude					
	5 km			10 km		
	Spread Distance	Date/Time	Figure No.	Spread Distance	Date/Time	Figure No.
Minimum	374.	920716-0000	483	1509.	940614-1800	542
5th percentile	4661.	930725-1200	514	14865.	930720-0600	513
10th percentile	6015.	930811-1800	516	21664.	940618-0000	543
25th percentile	10087.	930915-1800	518	34480.	940508-1800	538
Median	16210.	920918-1800	493	51189.	931004-0600	520
75th percentile	23569.	930102-0000	498	71857.	931015-1800	522
90th percentile	31085.	940123-0600	536	92770.	931213-0000	530
95th percentile	35244.	931126-0600	527	104650.	931128-0000	529
Maximum	51919.	931122-1800	526	155470.	931122-1800	526
Number of Valid Profiles	2934			2882		

Order Statistic	Intercept Altitude					
	20 km			30 km		
	Spread Distance	Date/Time	Figure No.	Spread Distance	Date/Time	Figure No.
Minimum	2662.	940722-1200	545	18325.	930906-0600	517
5th percentile	35577.	920713-0000	482	42776.	920719-1800	484
10th percentile	49595.	940613-1200	541	55039.	940601-1800	540
25th percentile	81767.	920809-1200	487	83602.	921002-0600	494
Median	114499.	930620-1800	509	118042.	920909-0000	491
75th percentile	149828.	931231-0000	532	154811.	930331-1800	505
90th percentile	181450.	930103-1800	500	194377.	930227-0600	502
95th percentile	201719.	940120-0000	535	208610.	921023-0600	495
Maximum	291053.	940106-0000	534	273285.	921115-1800	496
Number of Valid Profiles	2103			715		

**Table 18. Table of Travel Distances (m), Osan, South Korea**

Order Statistic	Intercept Altitude					
	5 km			10 km		
	Travel Distance	Date/Time	Figure No.	Travel Distance	Date/Time	Figure No.
Minimum	138.	920716-0000	483	439.	940614-1800	542
5th percentile	1603.	930726-0000	515	4760.	920829-1200	490
10th percentile	2080.	940627-1200	544	6887.	940727-1200	546
25th percentile	3465.	931011-0000	521	11025.	920827-0600	489
Median	5553.	920911-1200	492	16280.	931119-0000	525
75th percentile	8056.	940309-0000	537	22796.	930405-0000	506
90th percentile	10648.	931217-0000	531	29368.	930922-1800	519
95th percentile	12035.	931031-0600	523	32991.	930102-1800	499
Maximum	17699.	931122-1800	526	49329.	931122-1800	526
Number of Valid Profiles	2934			2882		

Order Statistic	Intercept Altitude					
	20 km			30 km		
	Travel Distance	Date/Time	Figure No.	Travel Distance	Date/Time	Figure No.
Minimum	731.	940722-1200	545	3337.	930529-0000	508
5th percentile	10303.	930718-1200	512	13776.	930705-0000	511
10th percentile	14124.	920802-0600	486	16489.	930703-1200	510
25th percentile	22985.	920813-1200	488	24132.	930321-0000	503
Median	31891.	920730-0600	485	32543.	930330-1200	504
75th percentile	41795.	930514-1800	507	41643.	931104-0600	524
90th percentile	51014.	940517-1200	539	52246.	930104-1200	501
95th percentile	57196.	940103-0600	533	56989.	921222-0000	497
Maximum	82490.	940106-0000	534	73033.	931126-1200	528
Number of Valid Profiles	2103			715		

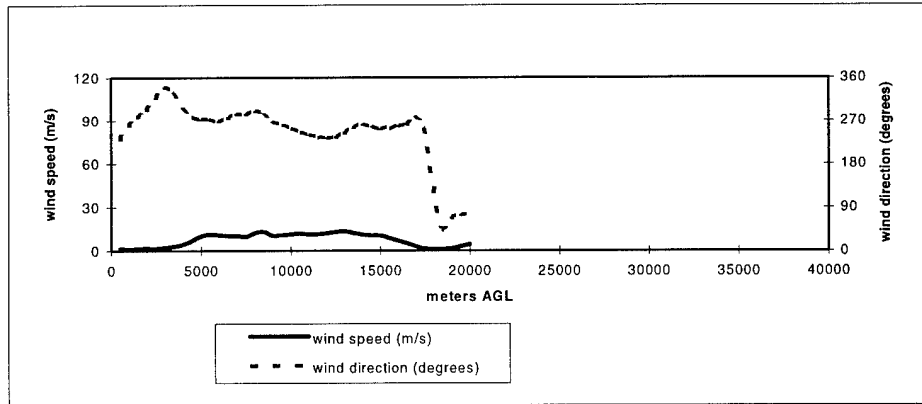


Figure 482. Osan 920713-0000

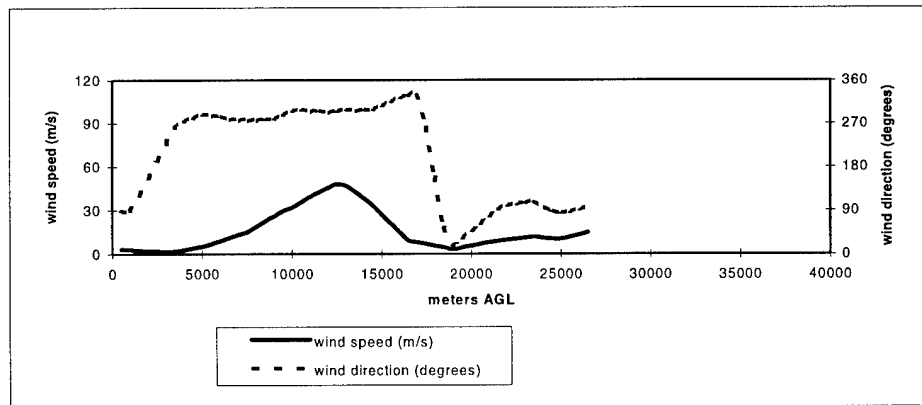


Figure 483. Osan 920716-0000

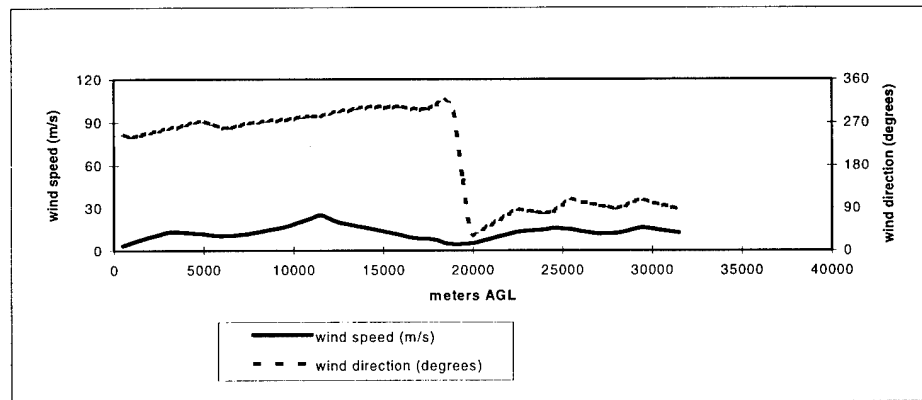


Figure 484. Osan 920719-1800

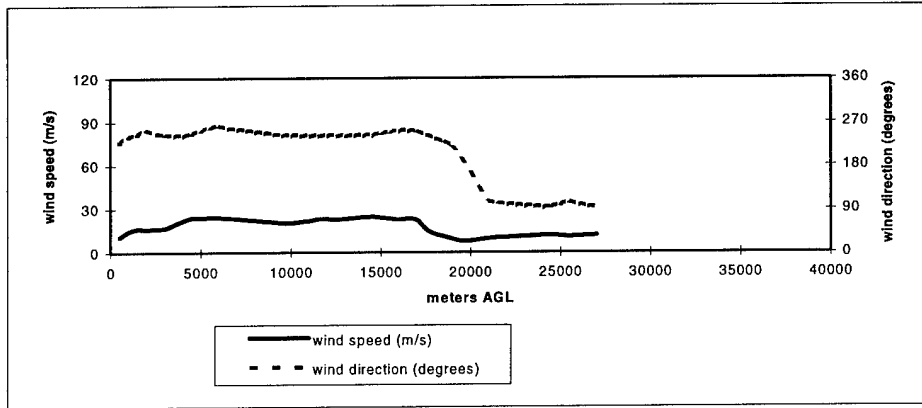


Figure 485. Osan 920730-0600

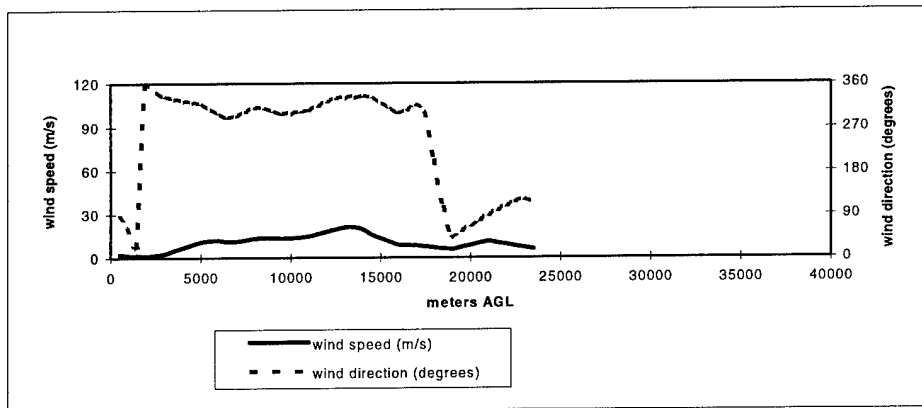


Figure 486. Osan 920802-0600

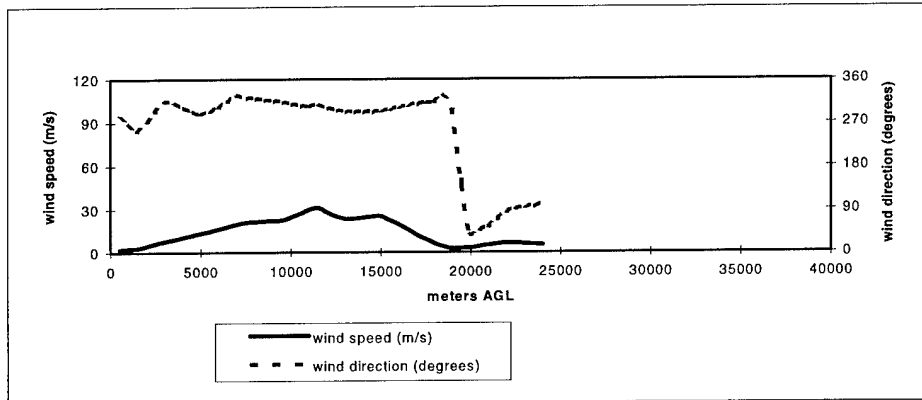


Figure 487. Osan 920809-1200



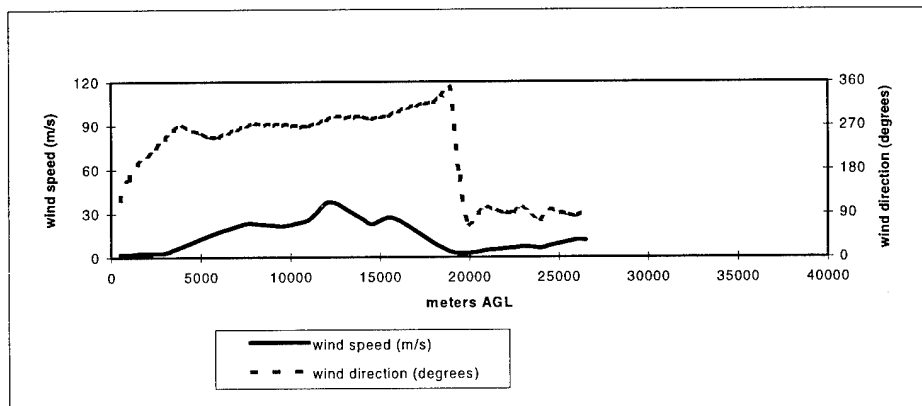


Figure 488. Osan 920813-1200

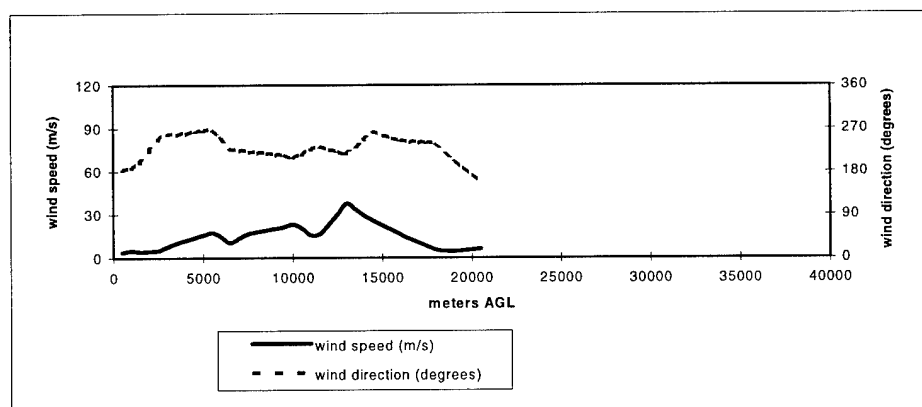


Figure 489. Osan 920827-0600

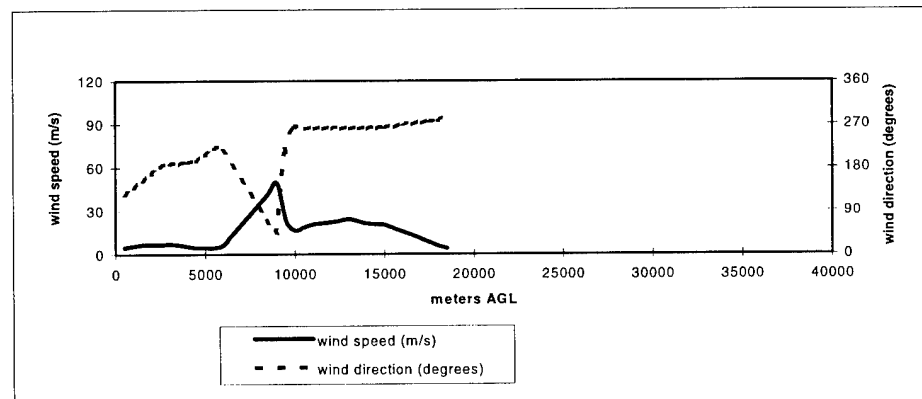
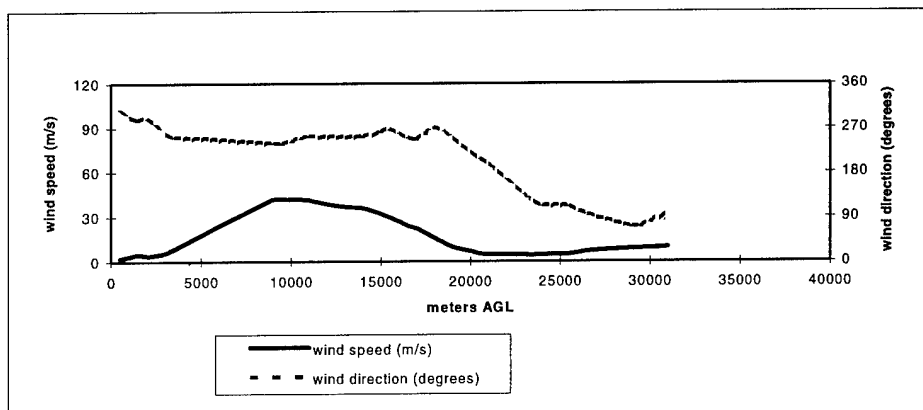
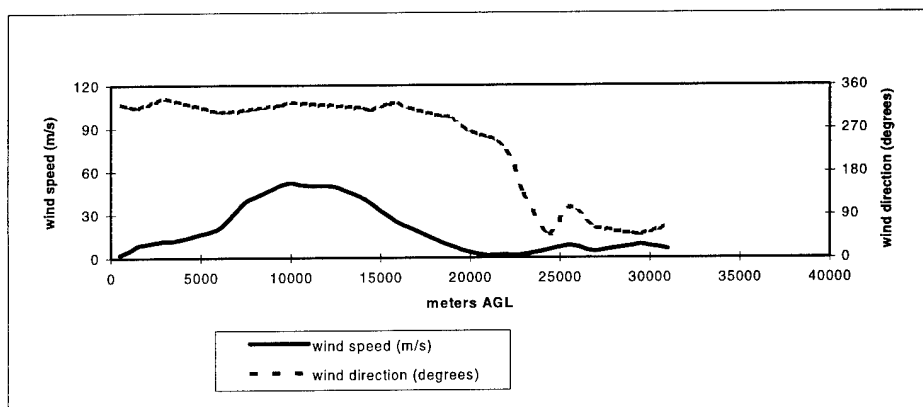


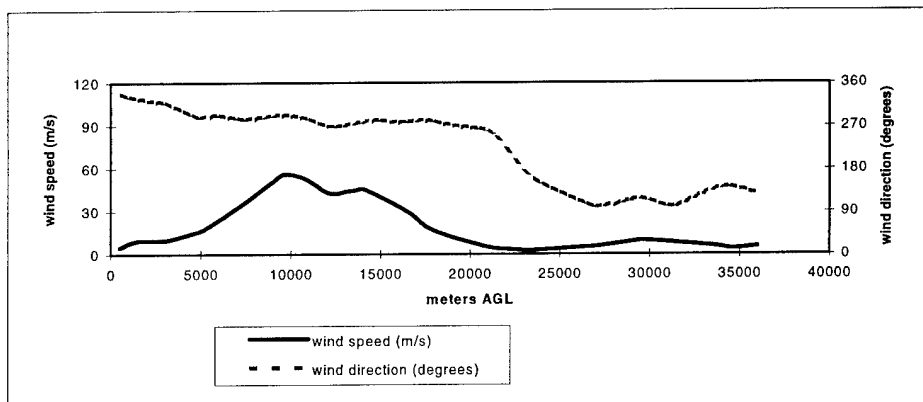
Figure 490. Osan 920829-1200



**Figure 491. Osan 920909-0000**



**Figure 492. Osan 920911-1200**



**Figure 493. Osan 920918-1800**

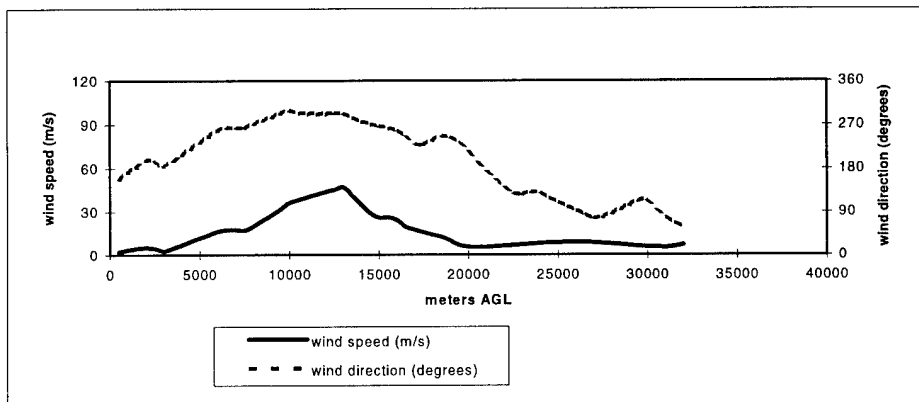


Figure 494. Osan 921002-0600

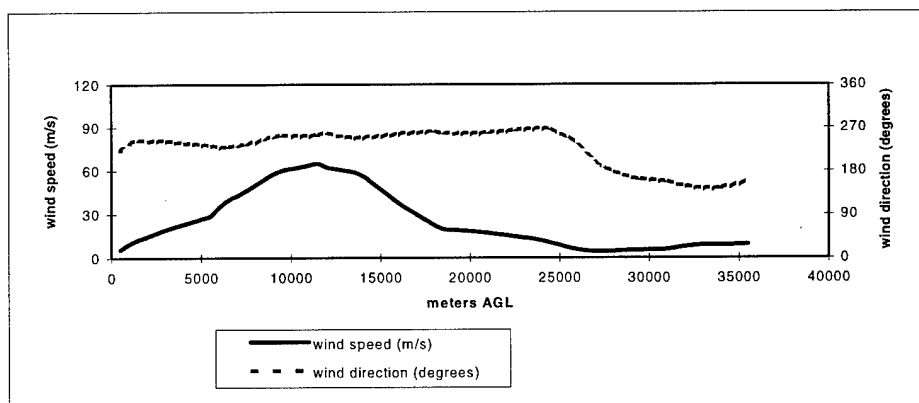


Figure 495. Osan 921023-0600

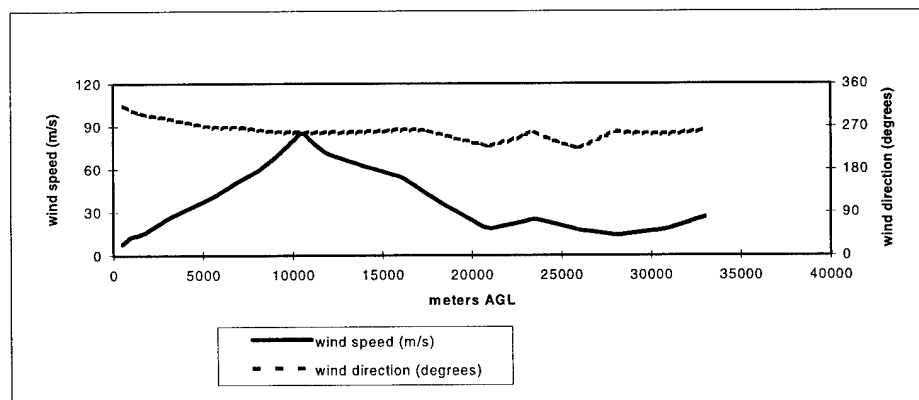


Figure 496. Osan 921115-1800

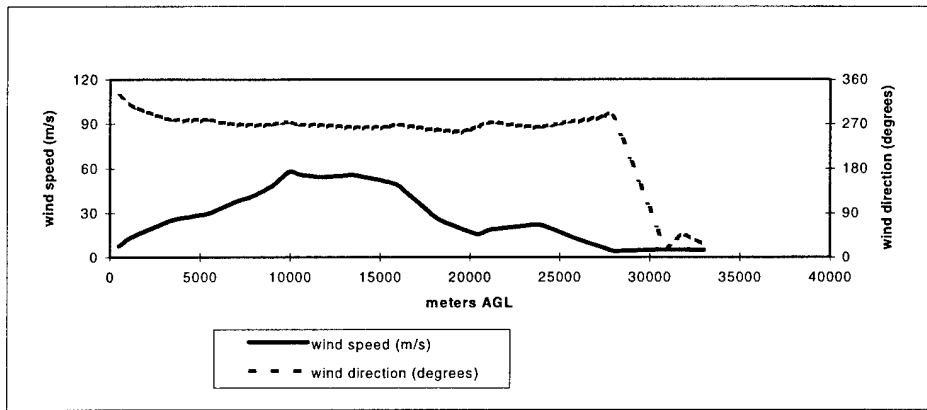


Figure 497. Osan 921222-0000

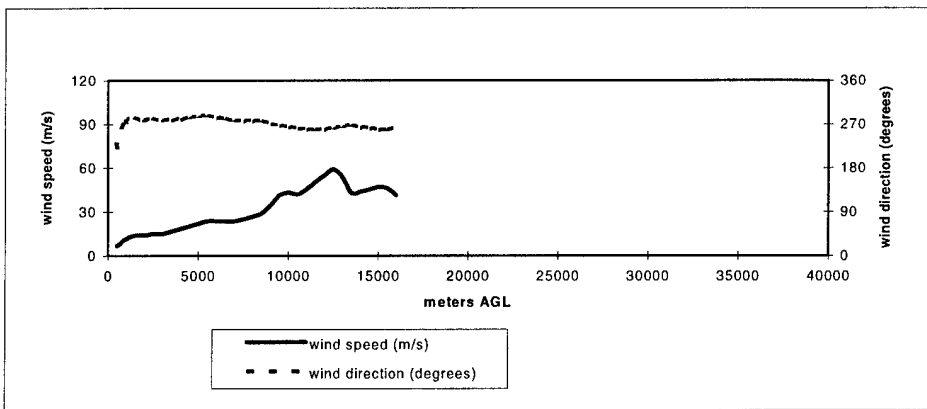


Figure 498. Osan 930102-0000

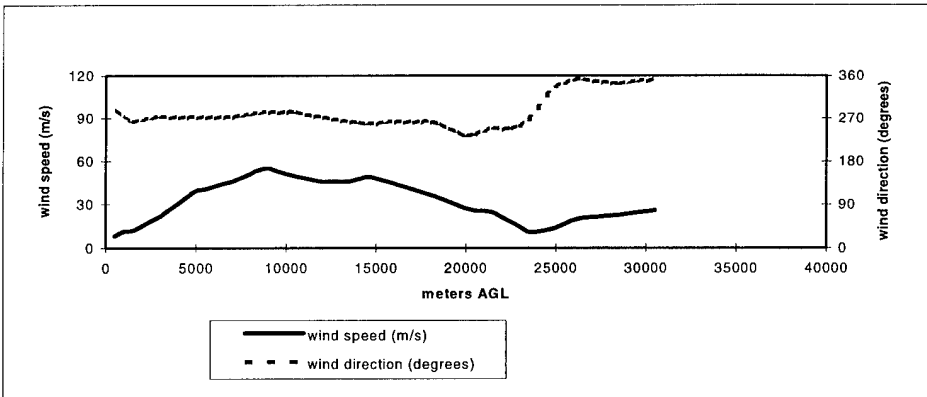
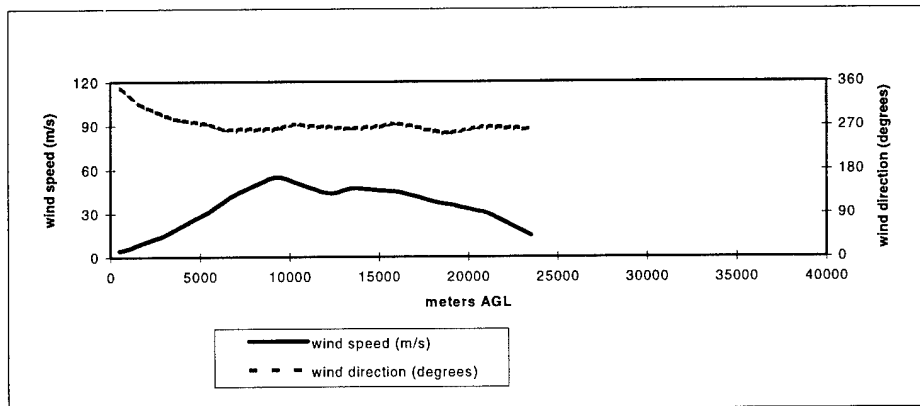
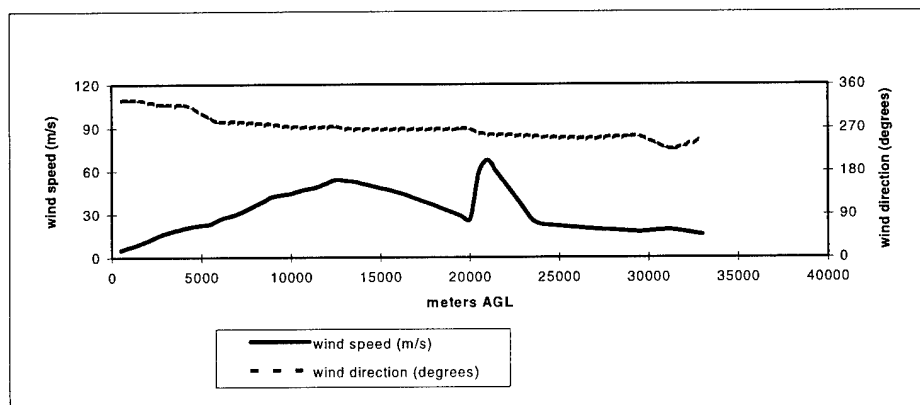


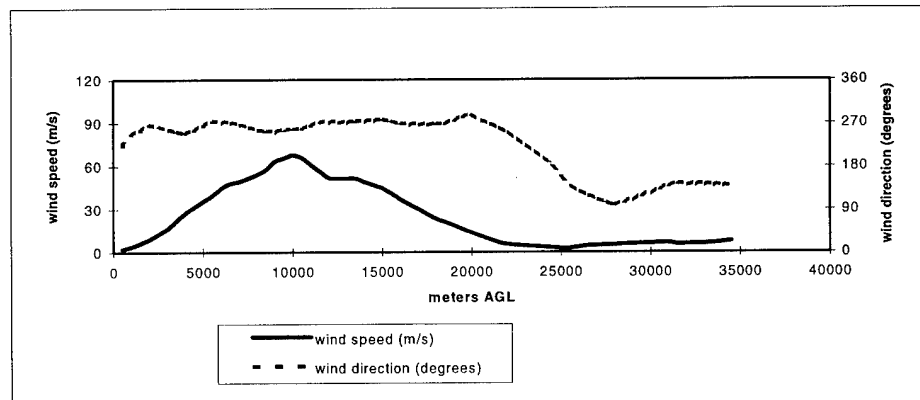
Figure 499. Osan 930102-1800



**Figure 500. Osan 930103-1800**



**Figure 501. Osan 930104-1200**



**Figure 502. Osan 930227-0600**

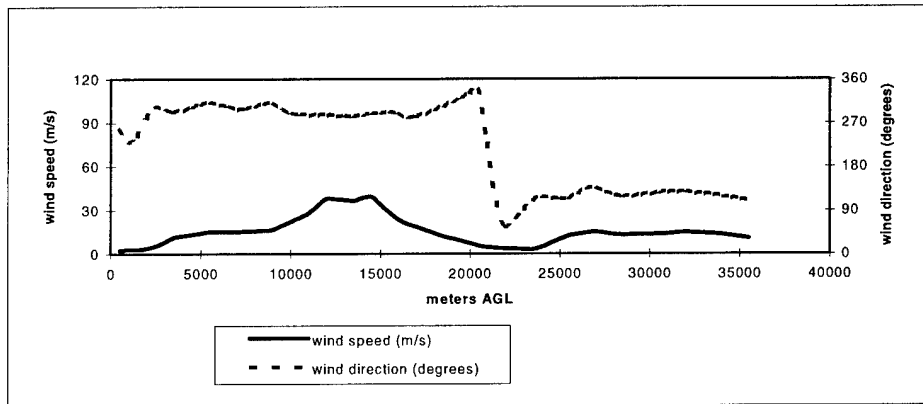


Figure 503. Osan 930321-0000

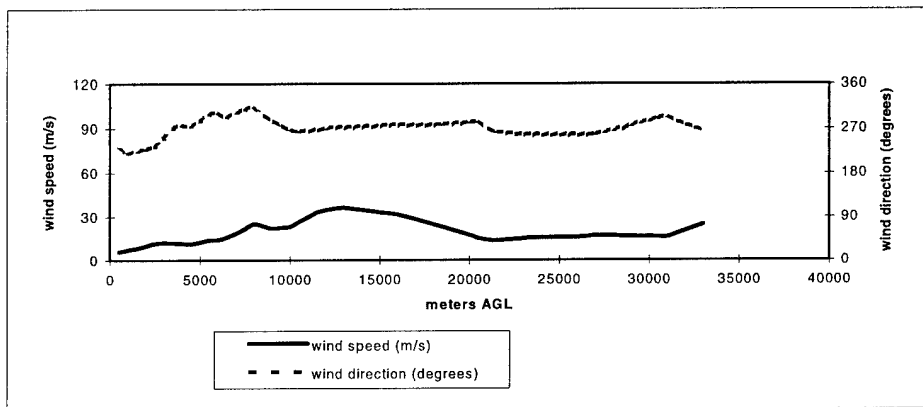


Figure 504. Osan 930330-1200

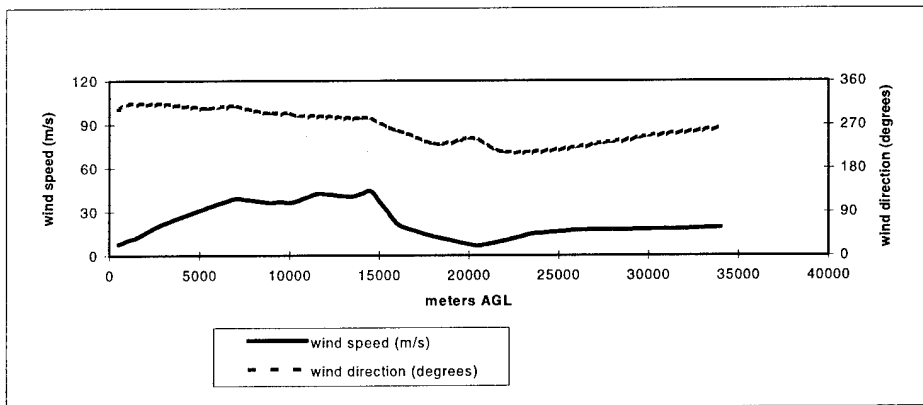


Figure 505. Osan 930331-1800

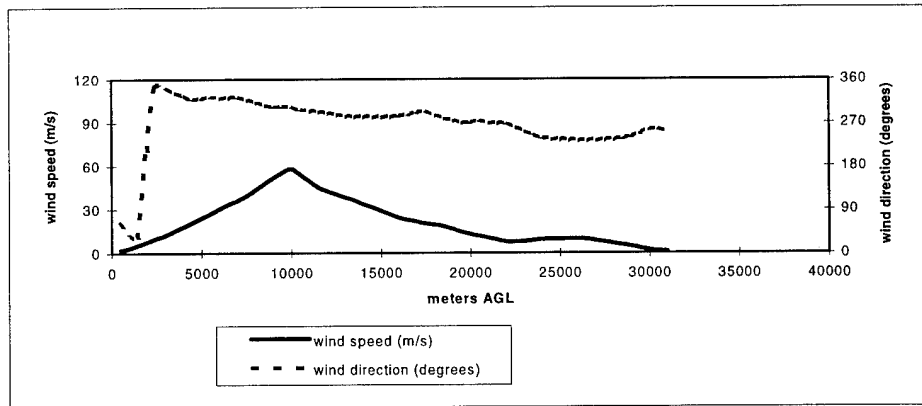


Figure 506. Osan 930405-0000

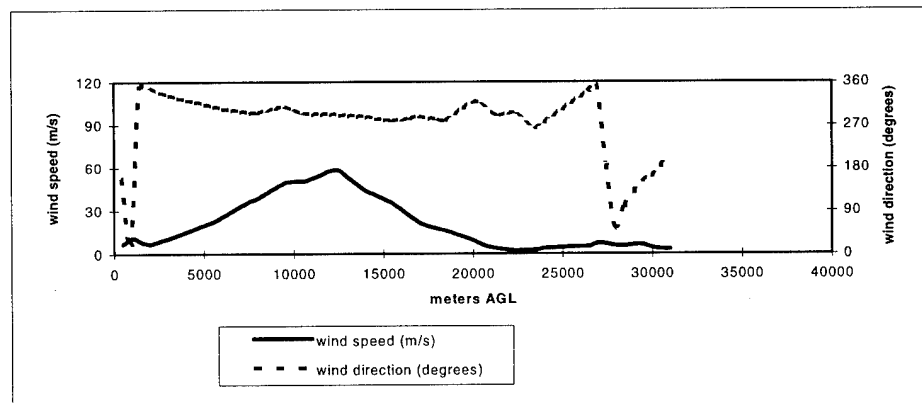


Figure 507. Osan 930514-1800

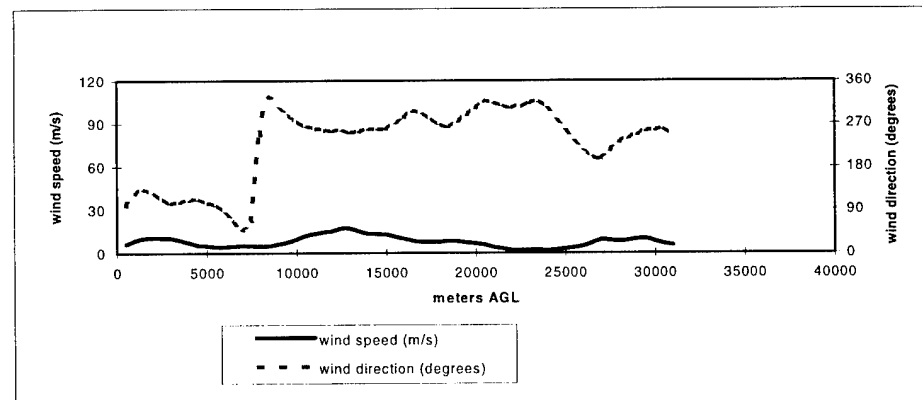


Figure 508. Osan 930529-0000

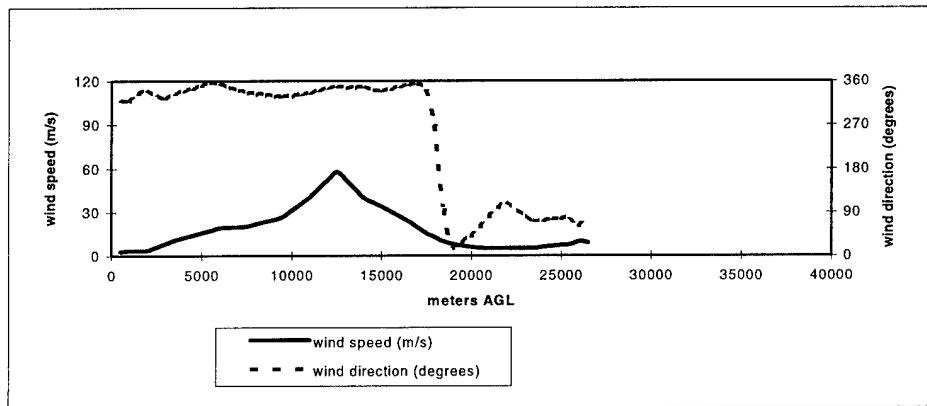


Figure 509. Osan 930620-1800

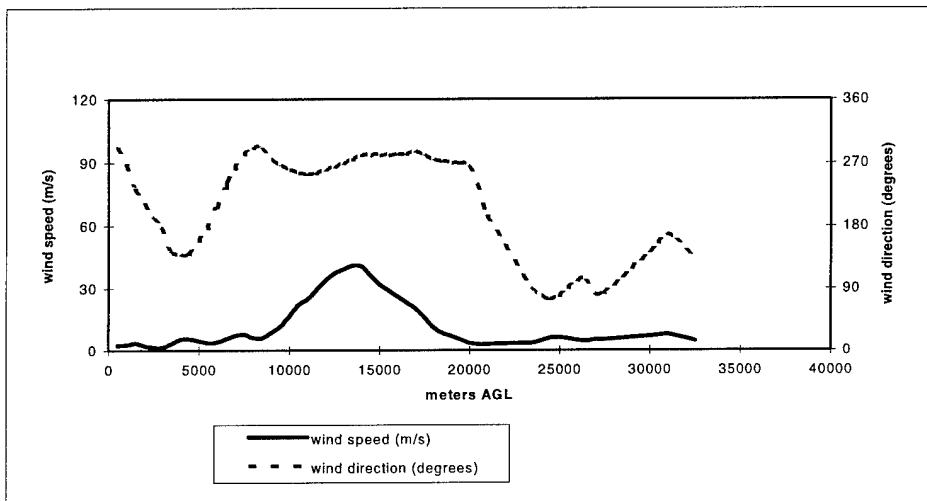


Figure 510. Osan 930703-1200

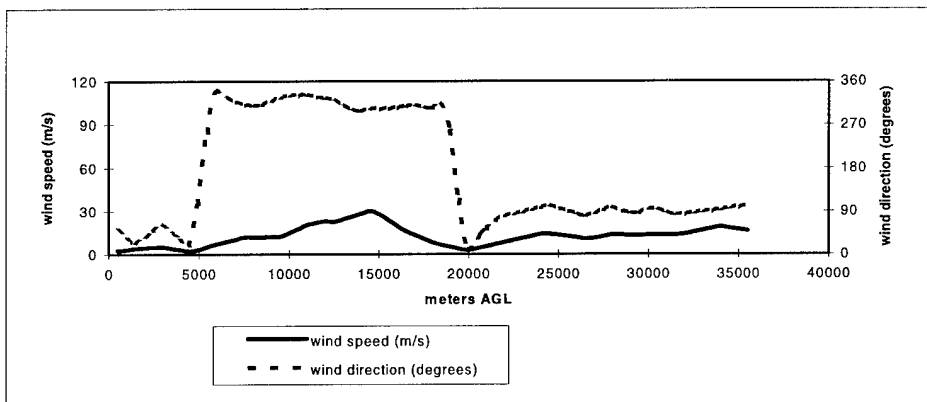


Figure 511. Osan 930705-0000



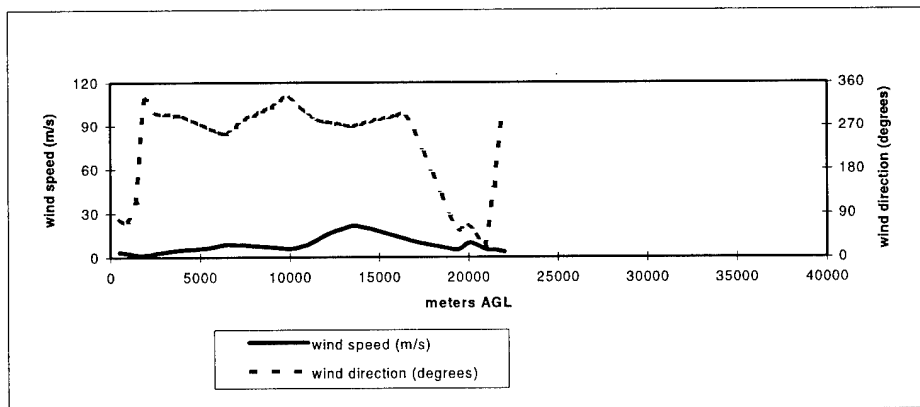


Figure 512. Osan 930718-1200

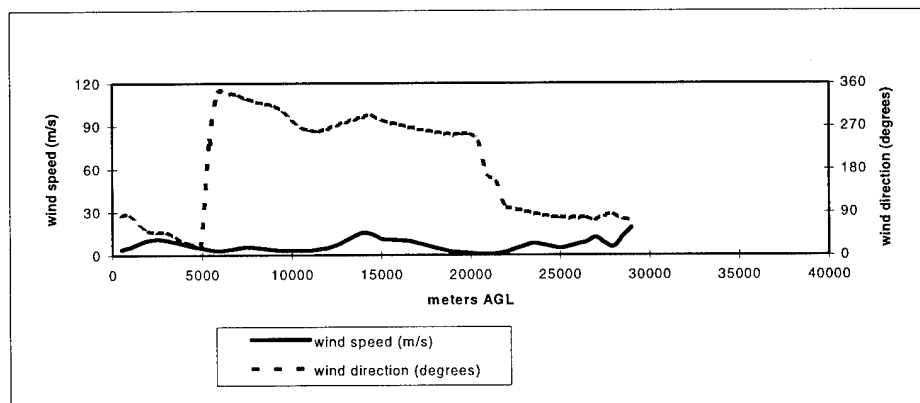


Figure 513. Osan 930720-0600

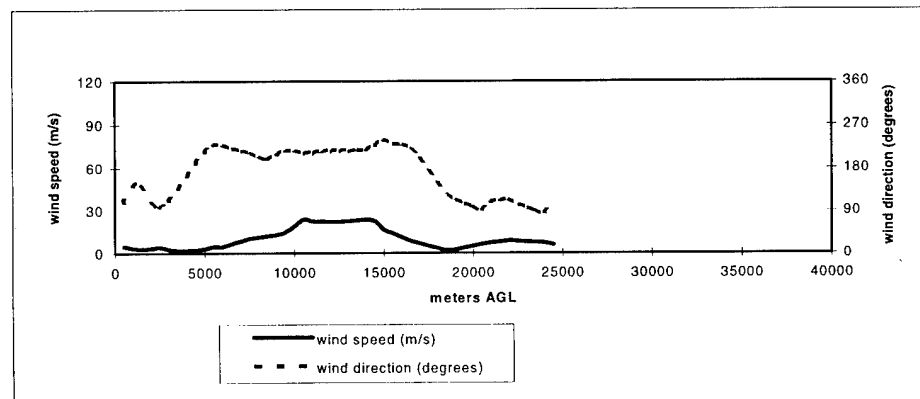
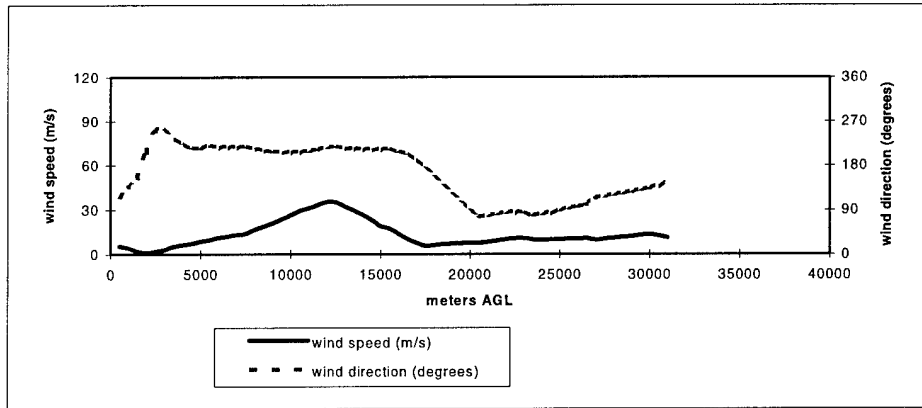
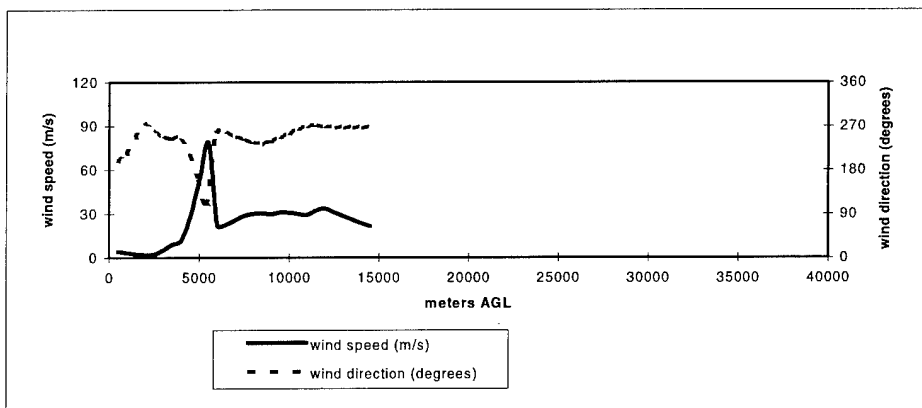


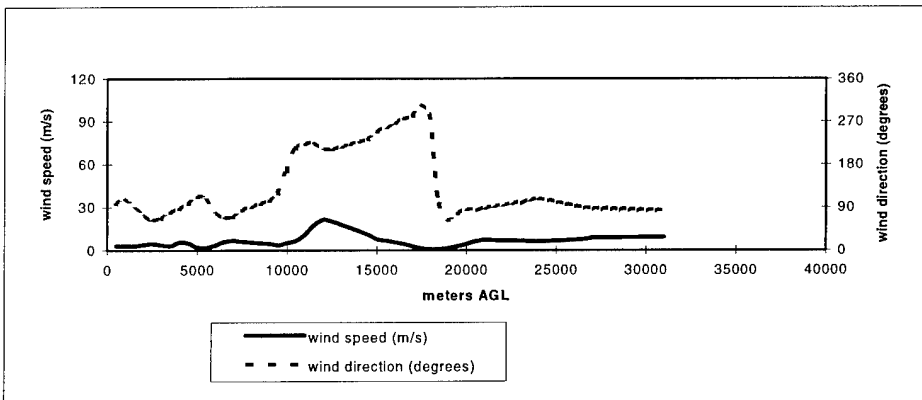
Figure 514. Osan 930725-1200



**Figure 515. Osan 930726-0000**



**Figure 516. Osan 930811-1800**



**Figure 517. Osan 930906-0600**

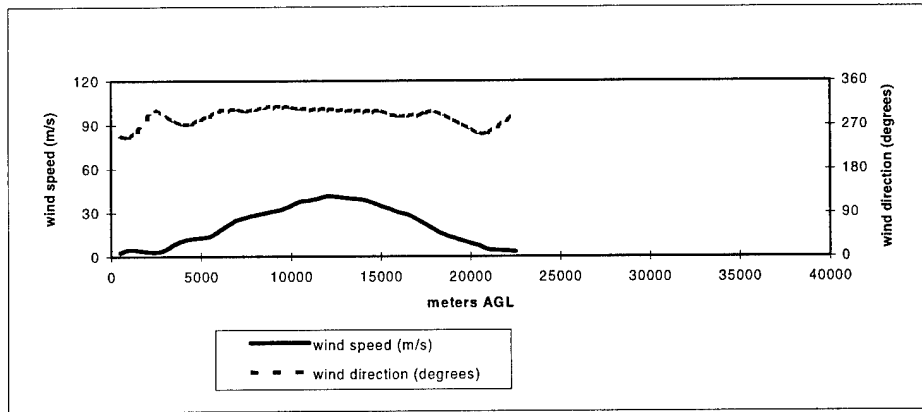


Figure 518. Osan 930915-1800

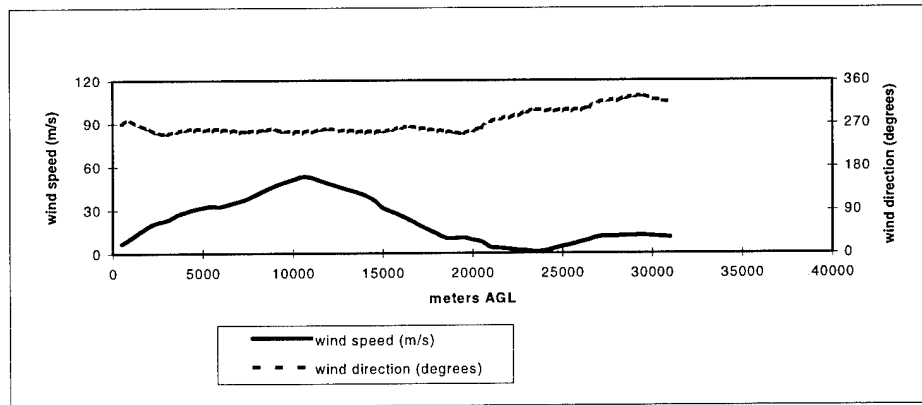


Figure 519. Osan 930922-1800

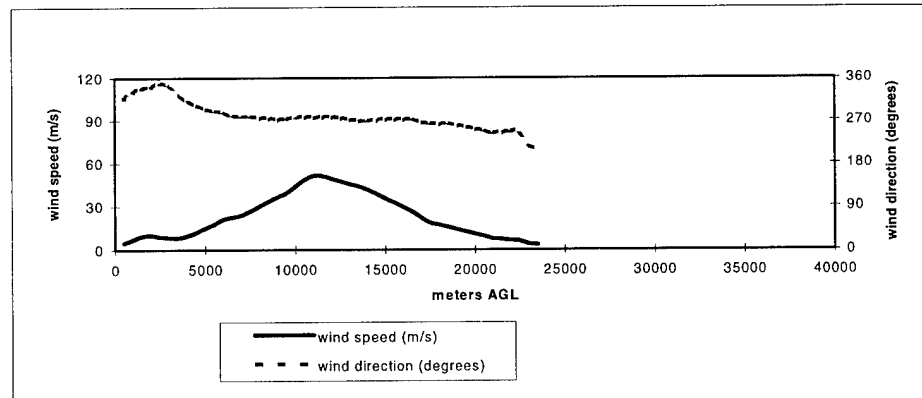
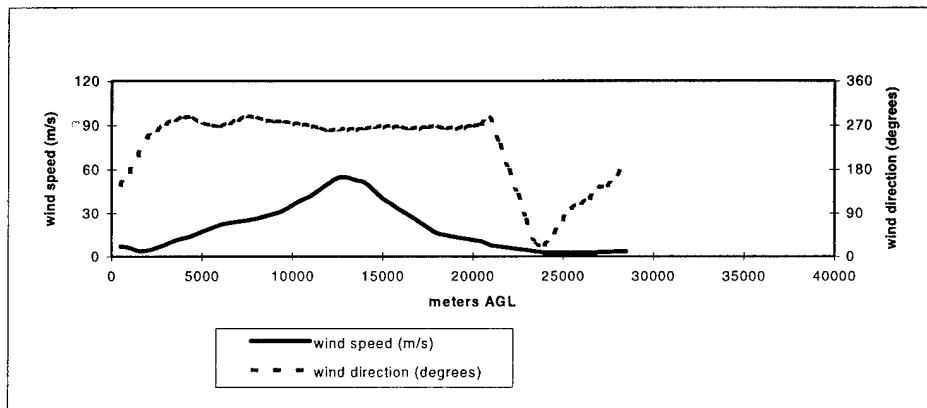
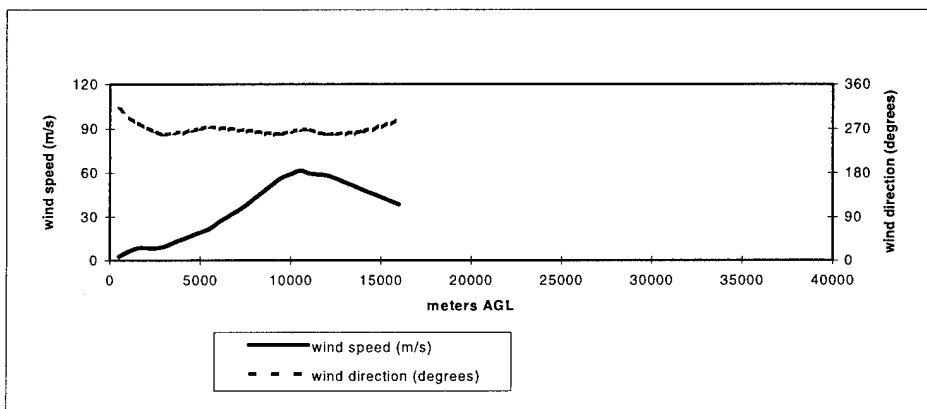


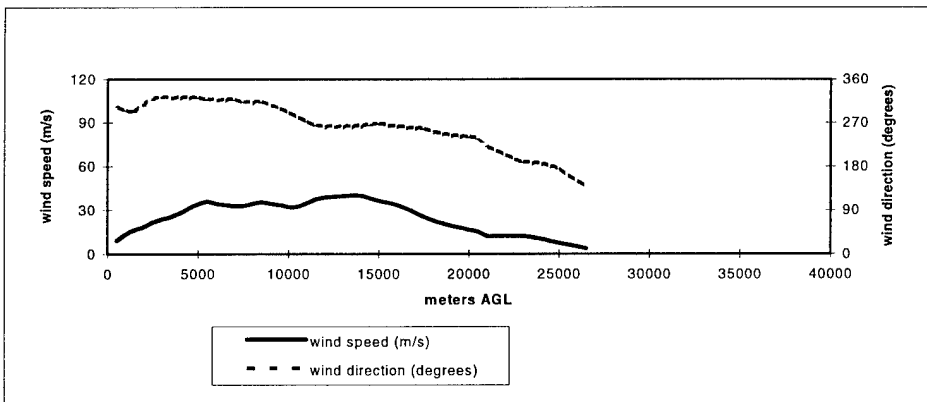
Figure 520. Osan 931004-0600



**Figure 521. Osan 931011-0000**



**Figure 522. Osan 931015-1800**



**Figure 523. Osan 931031-0600**

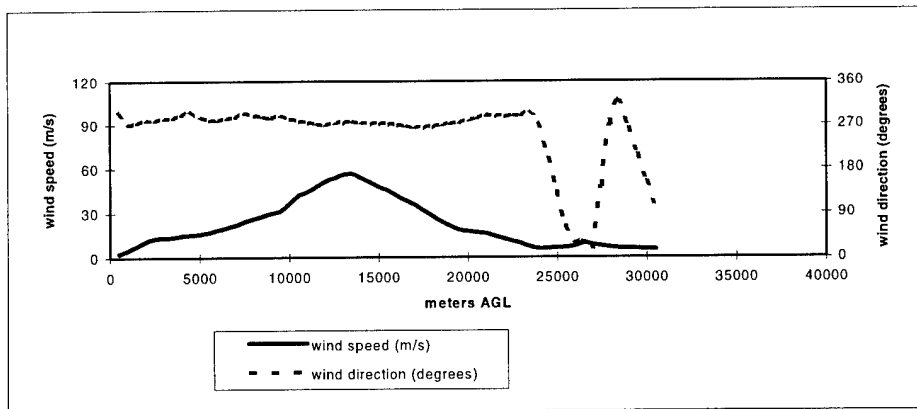


Figure 524. Osan 931104-0600

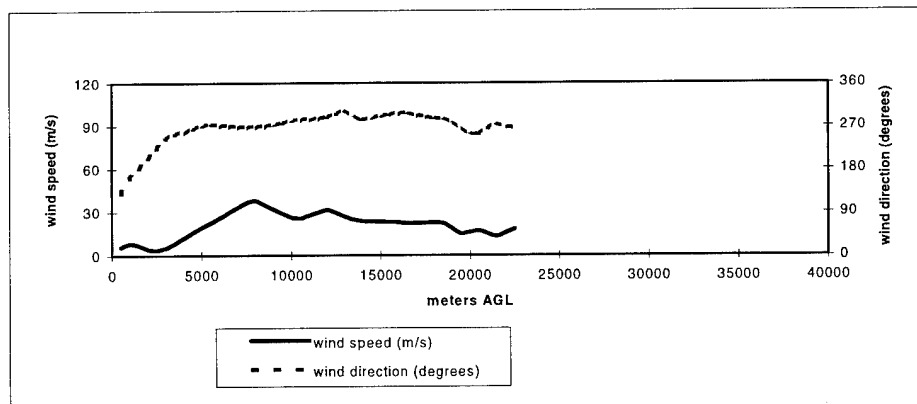


Figure 525. Osan 931119-0000

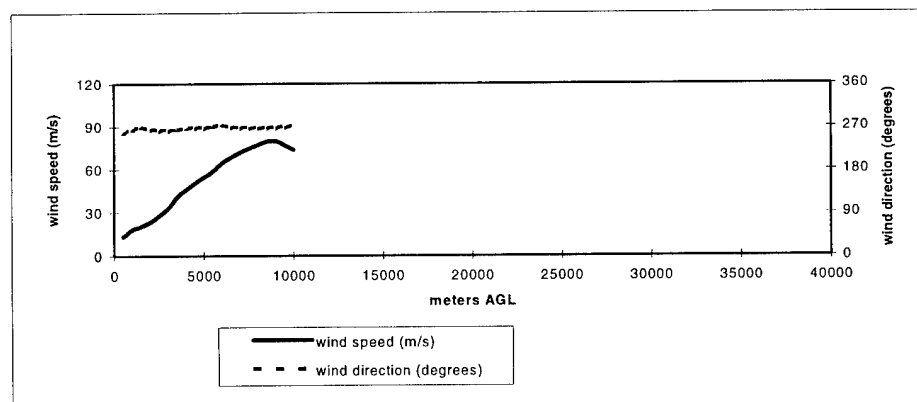


Figure 526. Osan 931122-1800

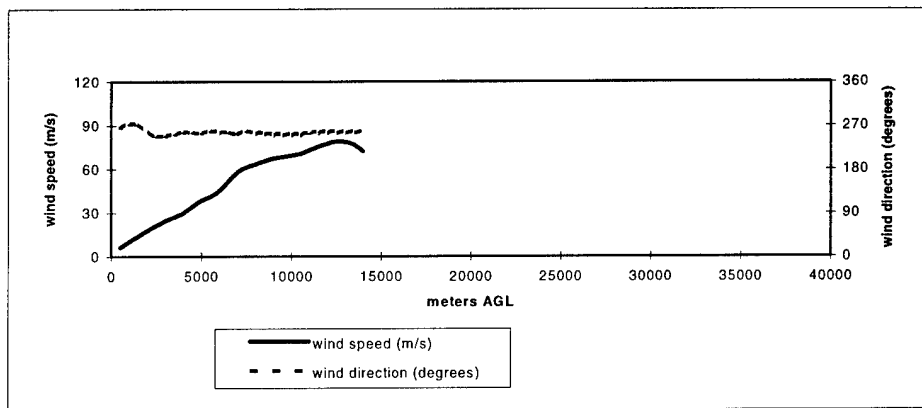


Figure 527. Osan 931126-0600

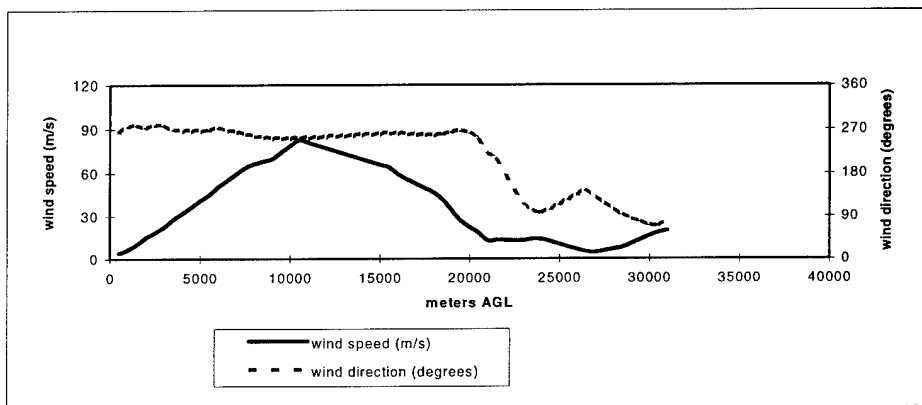


Figure 528. Osan 931126-1200

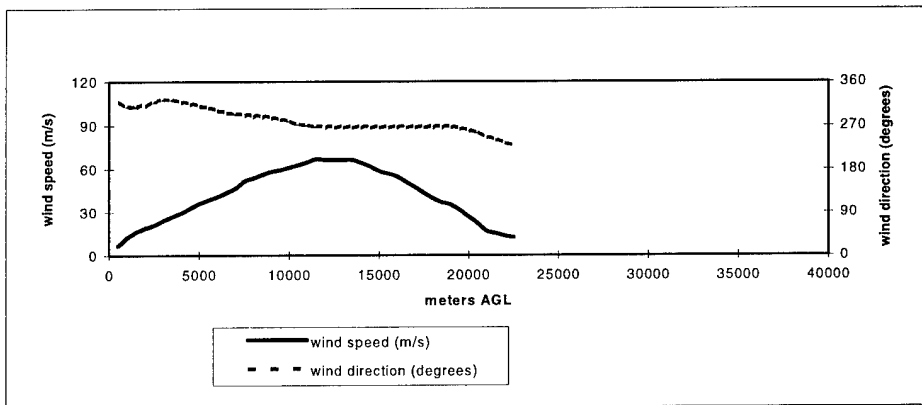


Figure 529. Osan 931128-0000

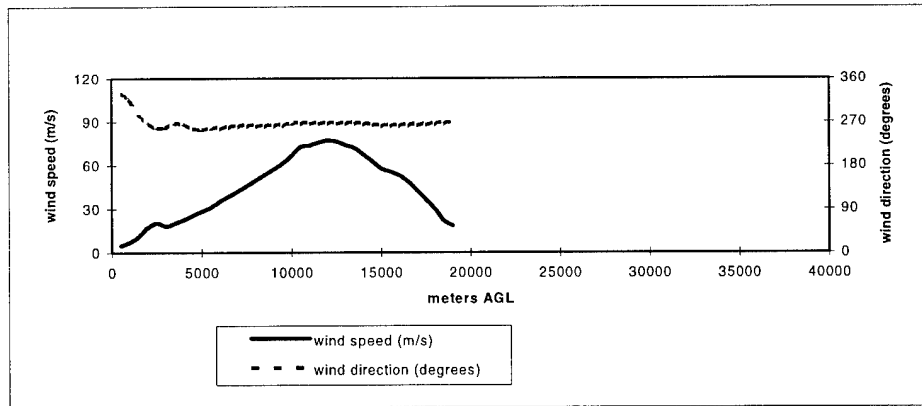


Figure 530. Osan 931213-0000

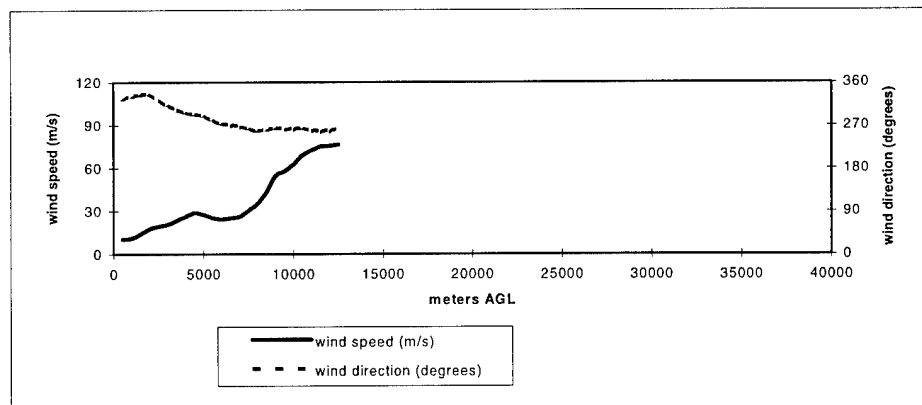


Figure 531. Osan 931217-0000

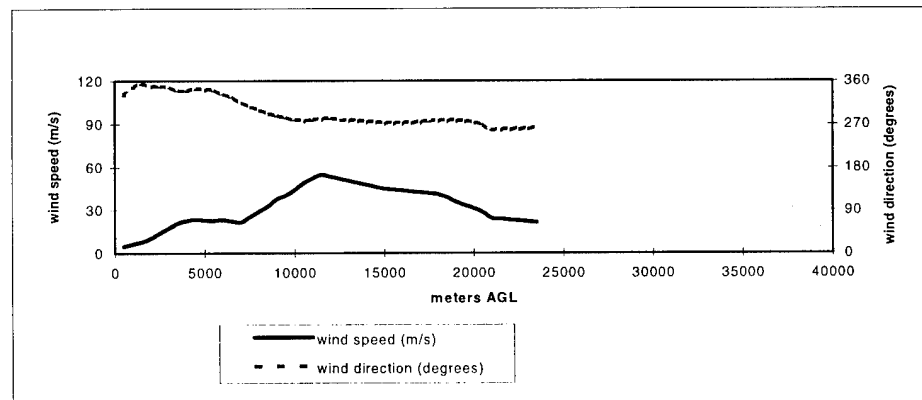
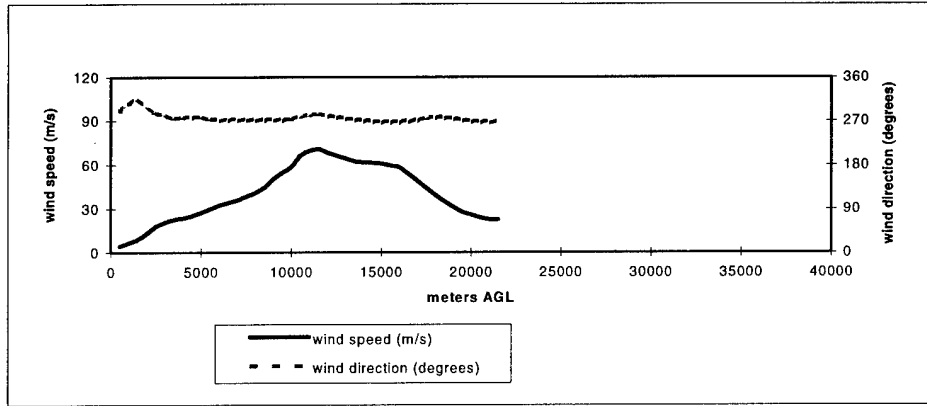
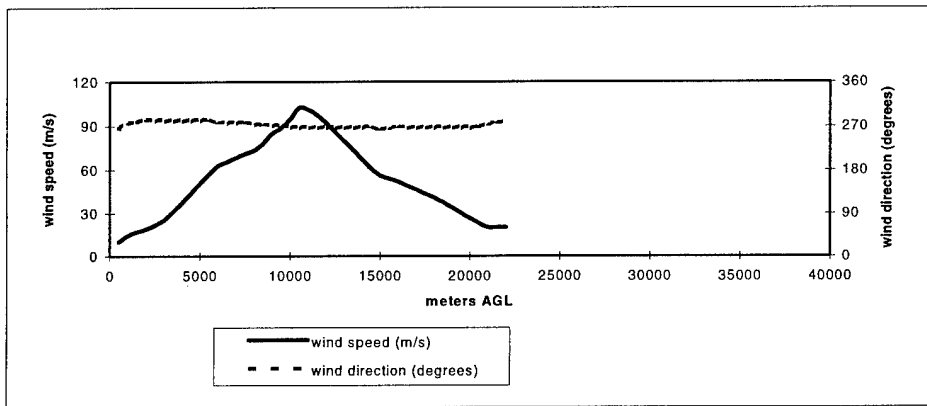


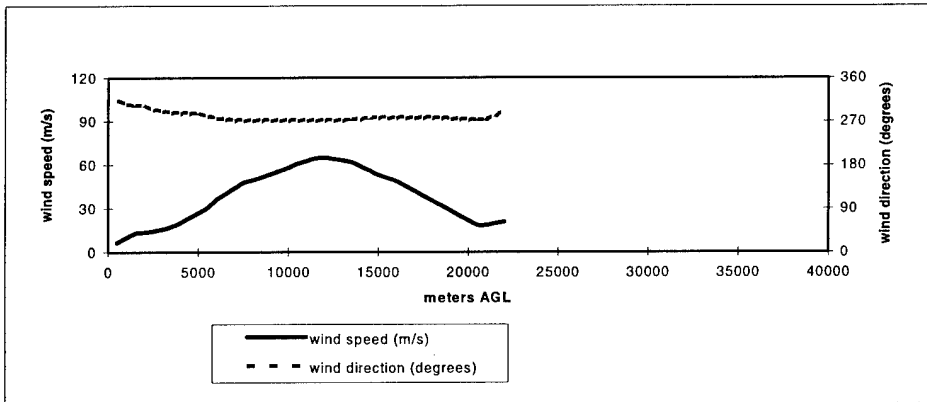
Figure 532. Osan 931231-0000



**Figure 533. Osan 940103-0600**



**Figure 534. Osan 940106-0000**



**Figure 535. Osan 940120-0000**



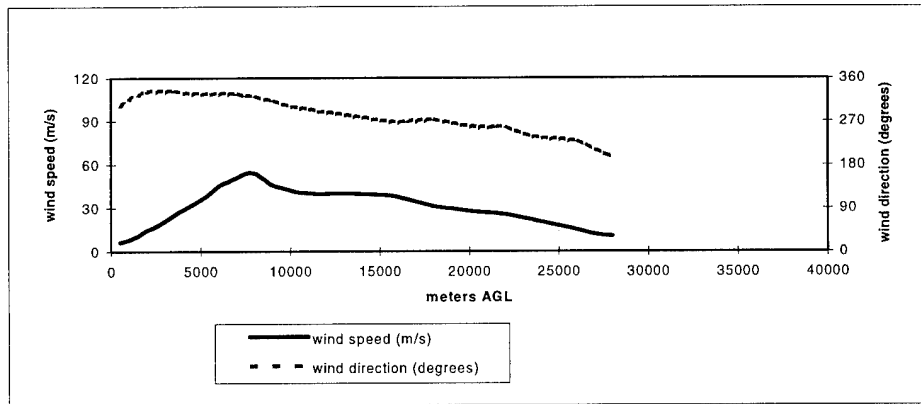


Figure 536. Osan 940123-0600

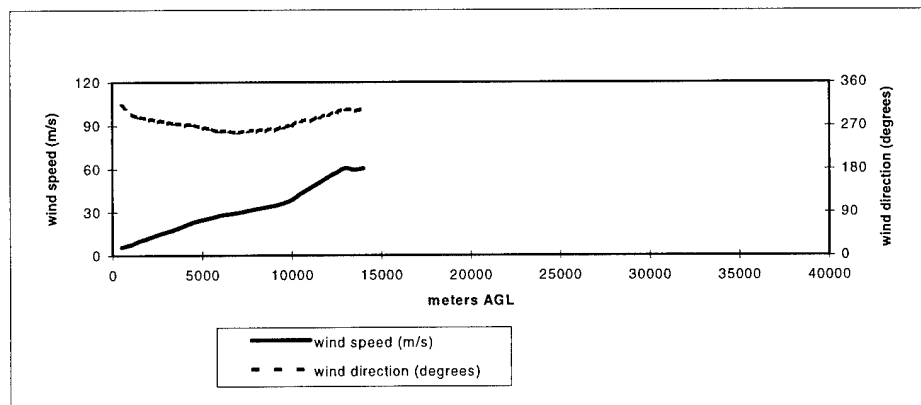


Figure 537. Osan 940309-0000

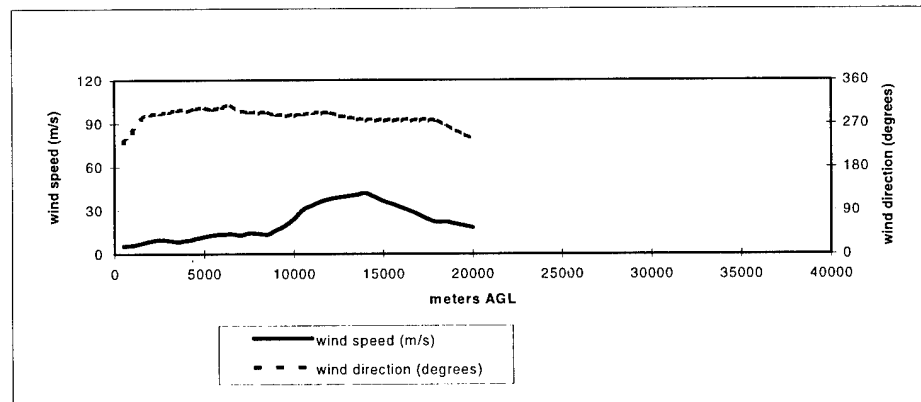
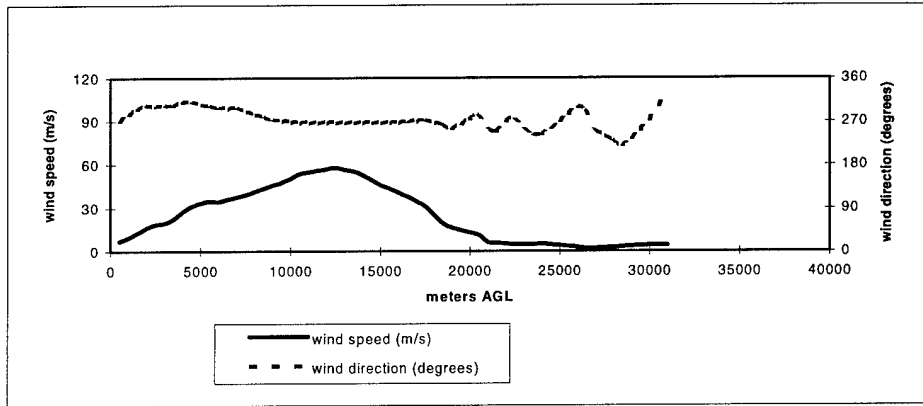
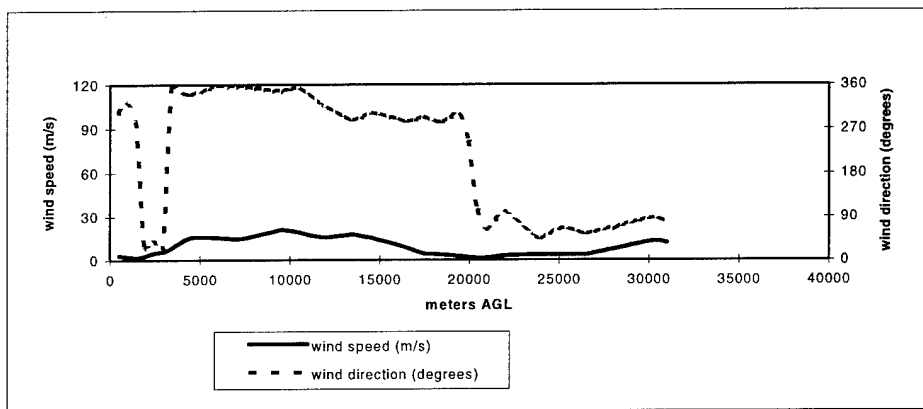


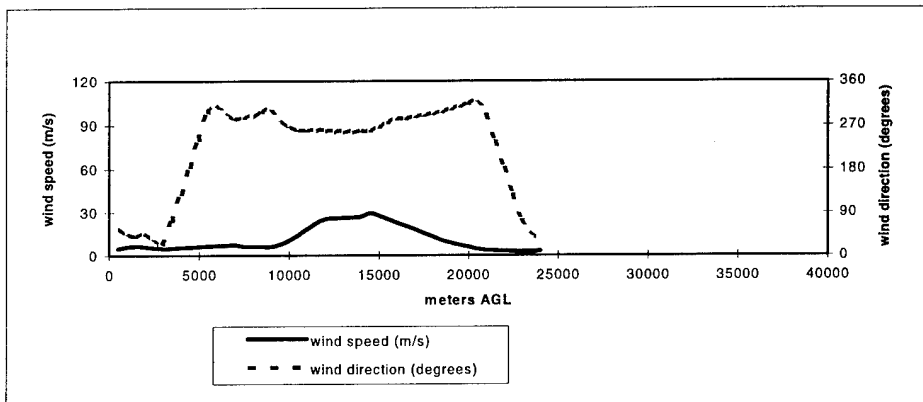
Figure 538. Osan 940508-1800



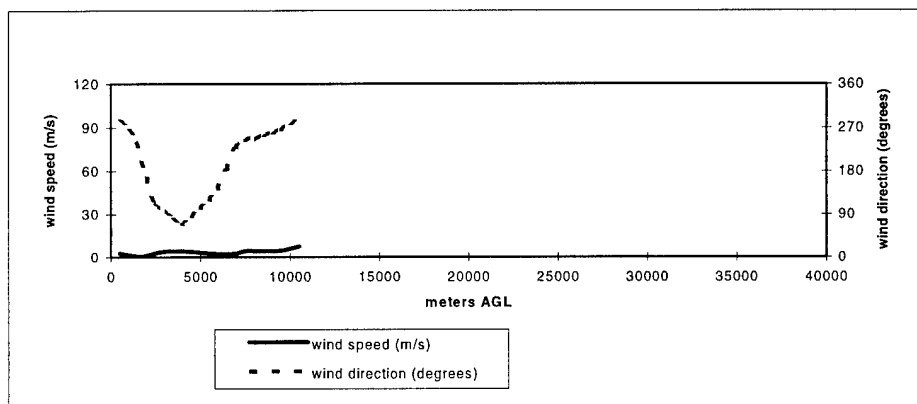
**Figure 539. Osan 940517-1200**



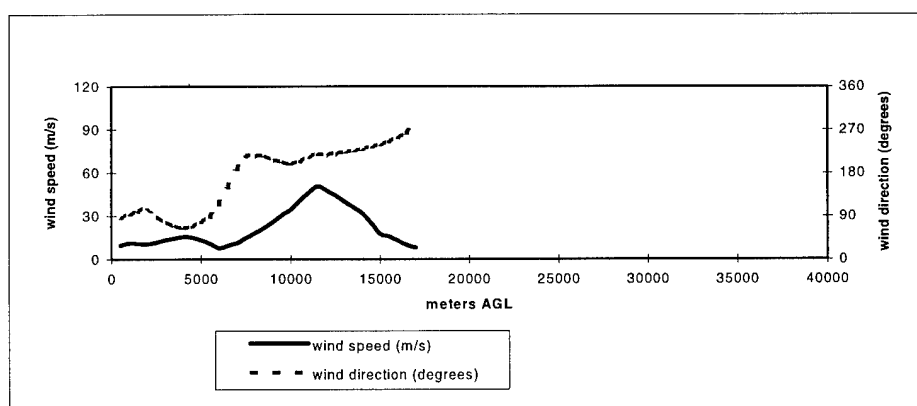
**Figure 540. Osan 940601-1800**



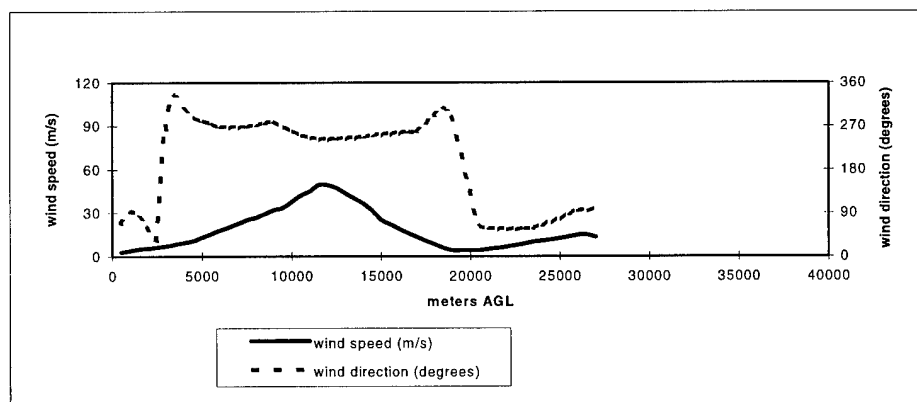
**Figure 541. Osan 940613-1200**



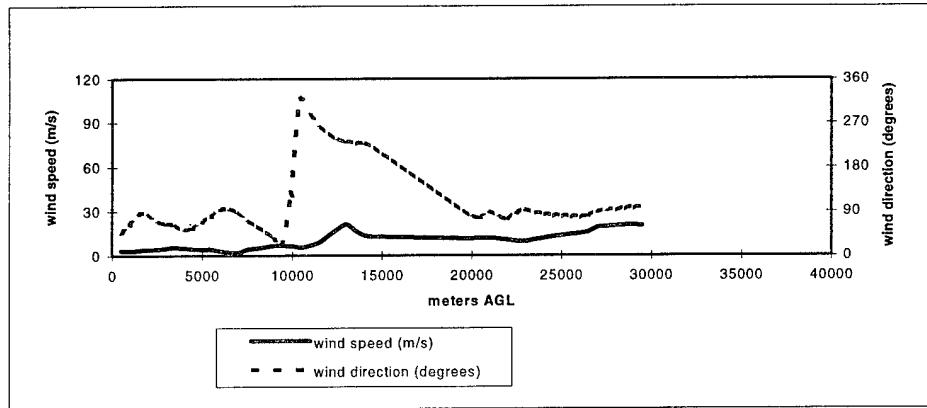
**Figure 542. Osan 940614-1800**



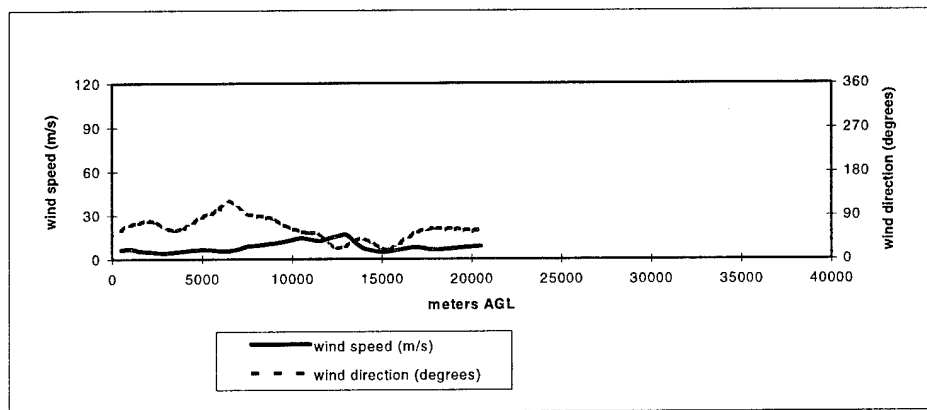
**Figure 543. Osan 940618-0000**



**Figure 544. Osan 940627-1200**



**Figure 545. Osan 940722-1200**



**Figure 546. Osan 940727-1200**

## 6.10 Bet Dagan, Israel

Table 19. Table of Spread Distances (m), Bet Dagan, Israel

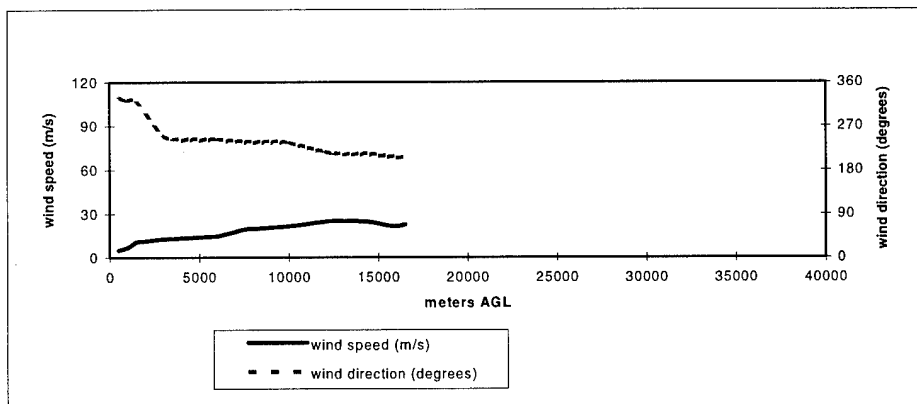
Order Statistic	Intercept Altitude					
	5 km			10 km		
	Spread Distance	Date/Time	Figure No.	Spread Distance	Date/Time	Figure No.
Minimum	316.	930720-0000	570	683.	930720-0000	570
5th percentile	2990.	930422-1200	565	10143.	930415-0600	564
10th percentile	4004.	930915-1200	576	14305.	940705-1200	590
25th percentile	6489.	920825-0000	548	21473.	930911-0000	574
Median	9880.	930531-1200	568	31589.	940619-1800	589
75th percentile	14657.	931121-0600	580	46652.	921211-0000	554
90th percentile	20896.	921212-0000	555	64360.	921125-1200	553
95th percentile	25127.	931112-0000	579	76610.	940423-1200	587
Maximum	41494.	930108-1200	558	125989.	930310-0000	562
Number of Valid Profiles	1851			1837		

Order Statistic	Intercept Altitude					
	20 km			30 km		
	Spread Distance	Date/Time	Figure No.	Spread Distance	Date/Time	Figure No.
Minimum	2176.	930724-1200	571	140032.	930223-0600	560
5th percentile	27075.	930625-1200	569	140032.	930223-0600	560
10th percentile	33137.	930726-1800	572	140032.	930223-0600	560
25th percentile	47435.	930914-0000	575	140032.	930223-0600	560
Median	72400.	940615-1800	588	140032.	930223-0600	560
75th percentile	108187.	940105-0600	581	140032.	930223-0600	560
90th percentile	140520.	940120-0600	583	140032.	930223-0600	560
95th percentile	161536.	930101-0000	557	140032.	930223-0600	560
Maximum	254341.	930311-1200	563	140032.	930223-0600	560
Number of Valid Profiles	1318			1		

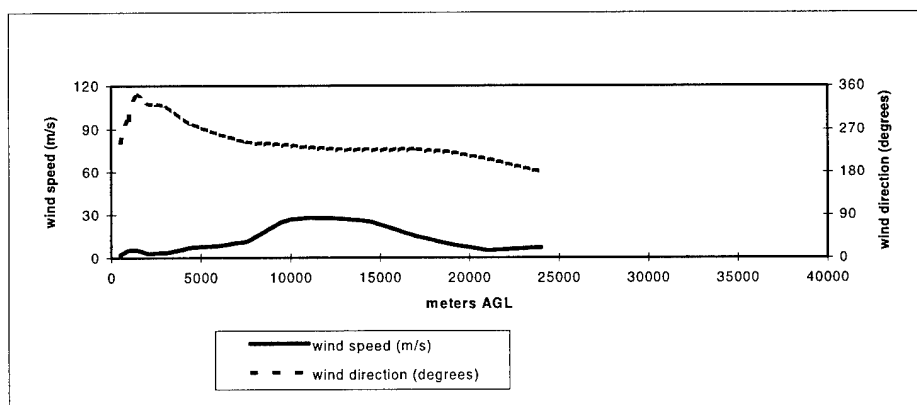
**Table 20. Table of Travel Distances (m), Bet Dagan, Israel**

Order Statistic	Intercept Altitude					
	5 km			10 km		
	Travel Distance	Date/Time	Figure No.	Travel Distance	Date/Time	Figure No.
Minimum	127.	930720-0000	570	228.	930720-0000	570
5th percentile	1039.	921105-1200	551	3267.	930117-1200	559
10th percentile	1375.	930529-0000	567	4554.	921015-0600	550
25th percentile	2228.	920825-0000	548	6862.	930928-0000	578
Median	3390.	930531-1200	568	10104.	921009-1200	549
75th percentile	5011.	920701-1300	547	14921.	940127-1200	584
90th percentile	7177.	940116-0000	582	20603.	930227-0000	561
95th percentile	8633.	931112-0000	579	24528.	921124-0600	552
Maximum	14289.	930108-1200	558	40002.	930310-0000	562
Number of Valid Profiles	1851			1837		

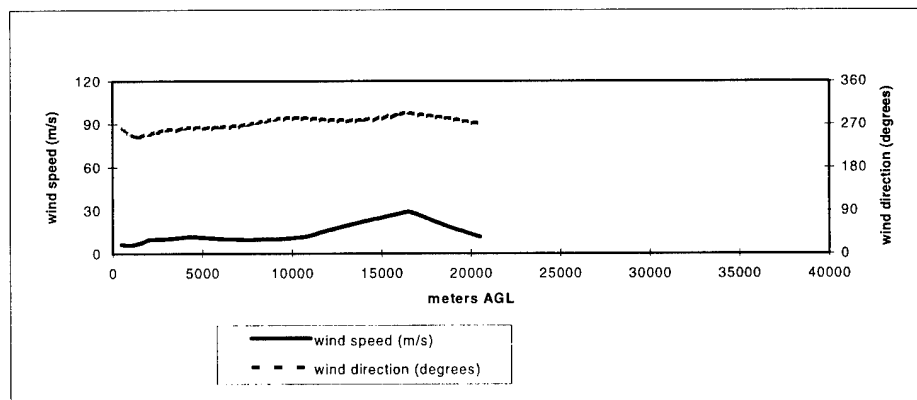
Order Statistic	Intercept Altitude					
	20 km			30 km		
	Travel Distance	Date/Time	Figure No.	Travel Distance	Date/Time	Figure No.
Minimum	697.	930724-1200	571	35726.	930223-0600	560
5th percentile	7251.	930814-1800	573	35726.	930223-0600	560
10th percentile	9302.	940416-1200	586	35726.	930223-0600	560
25th percentile	13558.	940807-0000	591	35726.	930223-0600	560
Median	20445.	930925-1800	577	35726.	930223-0600	560
75th percentile	29948.	930527-1200	566	35726.	930223-0600	560
90th percentile	39214.	921212-1200	556	35726.	930223-0600	560
95th percentile	45412.	940207-1200	585	35726.	930223-0600	560
Maximum	71328.	930311-1200	563	35726.	930223-0600	560
Number of Valid Profiles	1318			1		



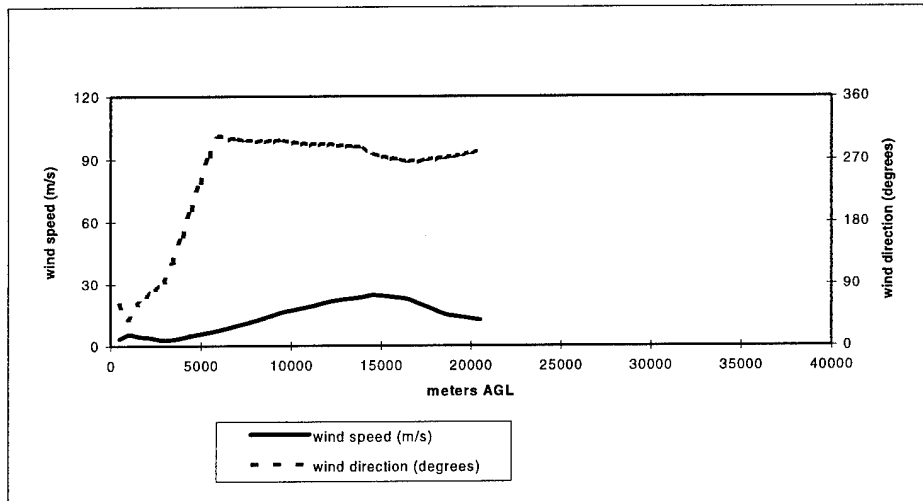
**Figure 547. Bet Dagan 920701-1300**



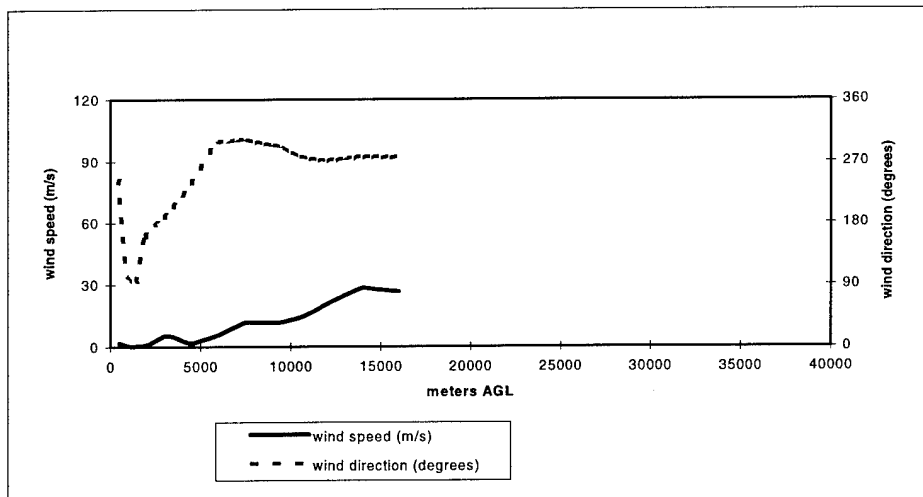
**Figure 548. Bet Dagan 920825-0000**



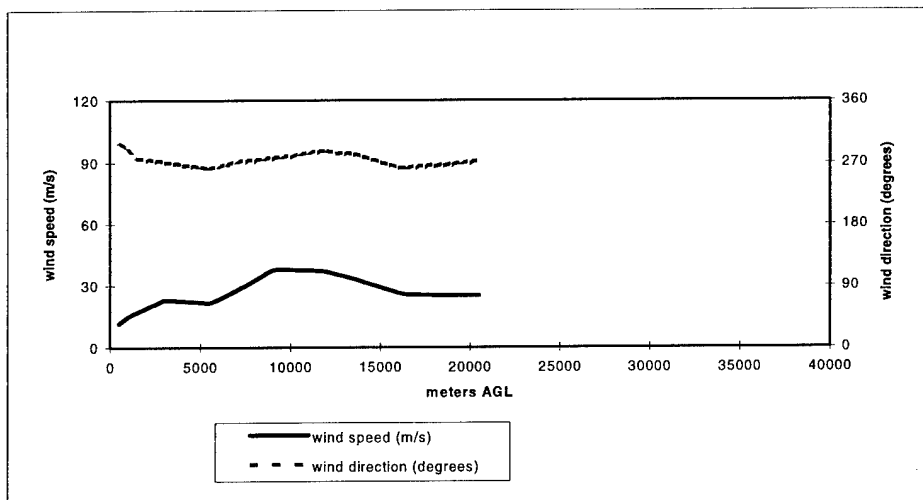
**Figure 549. Bet Dagan 921009-1200**



**Figure 550. Bet Dagan 921015-0600**



**Figure 551. Bet Dagan 921105-1200**



**Figure 552. Bet Dagan 921124-0600**



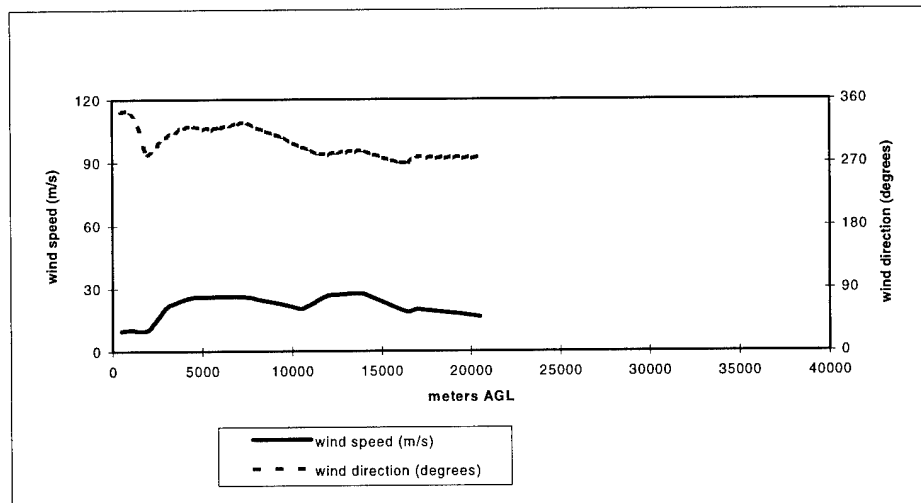


Figure 553. Bet Dagan 921125-1200

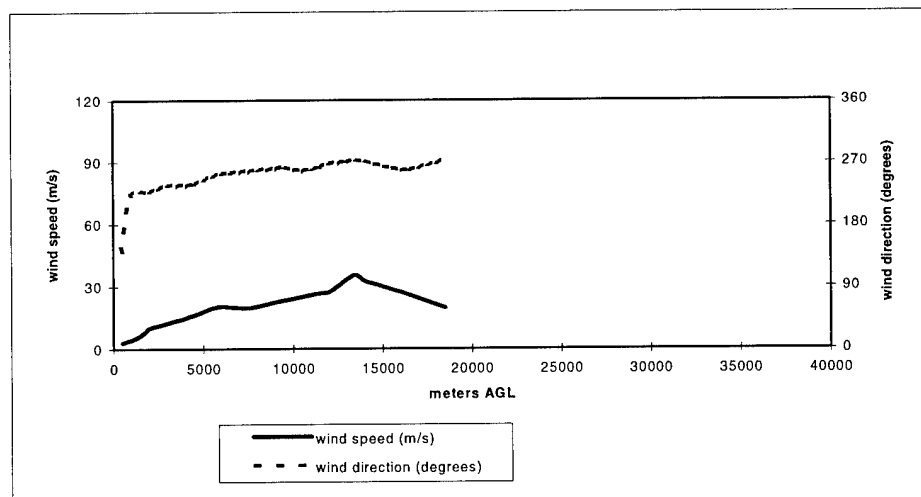


Figure 554. Bet Dagan 921211-0000

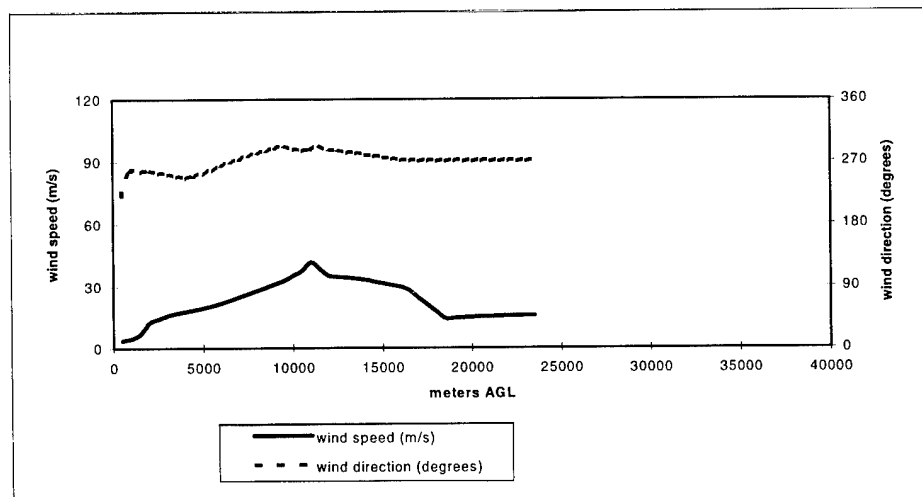
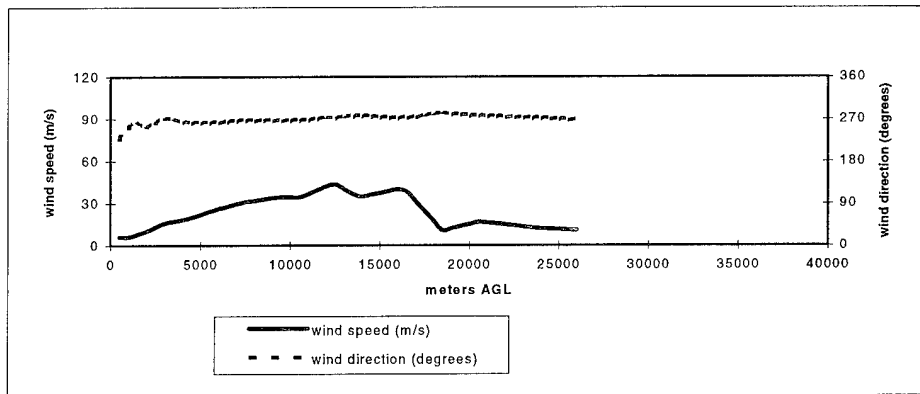
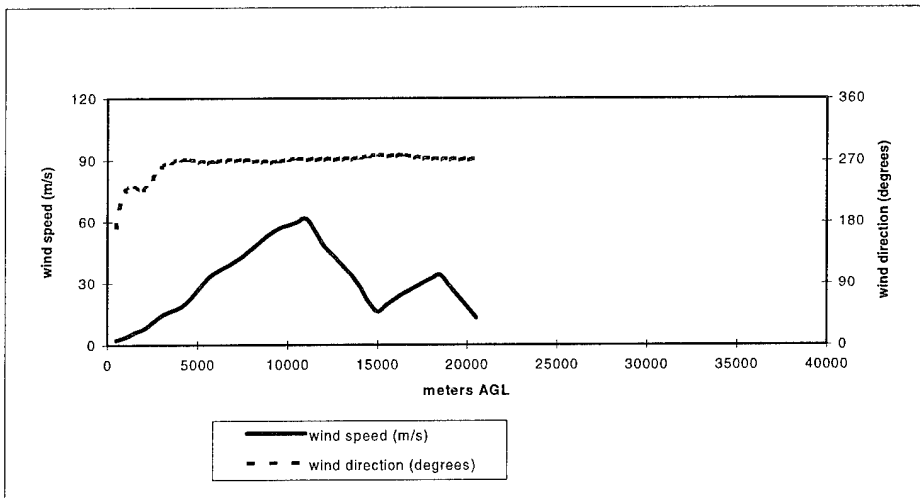


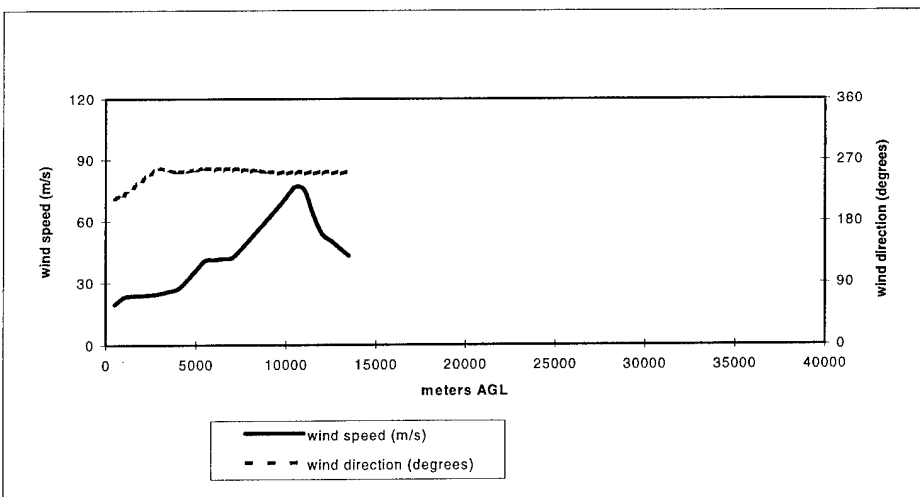
Figure 555. Bet Dagan 921212-0000



**Figure 556. Bet Dagan 921212-1200**



**Figure 557. Bet Dagan 930101-0000**



**Figure 558. Bet Dagan 930108-1200**

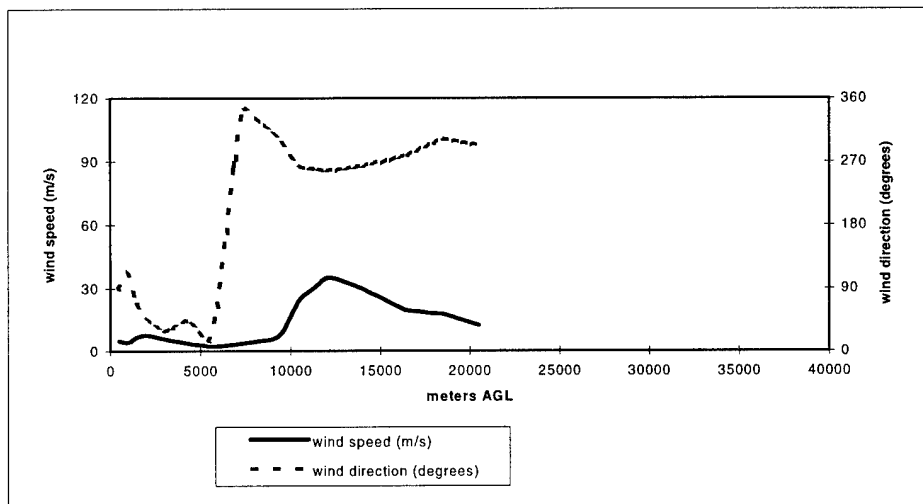


Figure 559. Bet Dagan 930117-1200

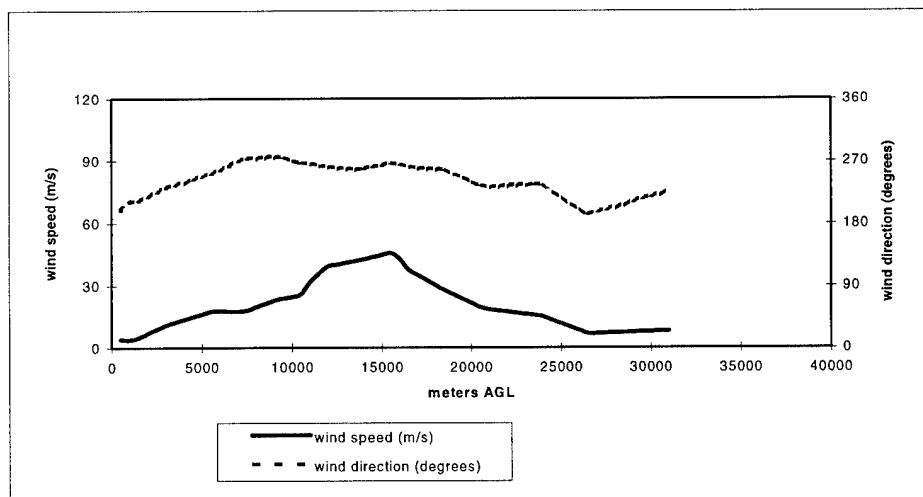


Figure 560. Bet Dagan 930223-0600

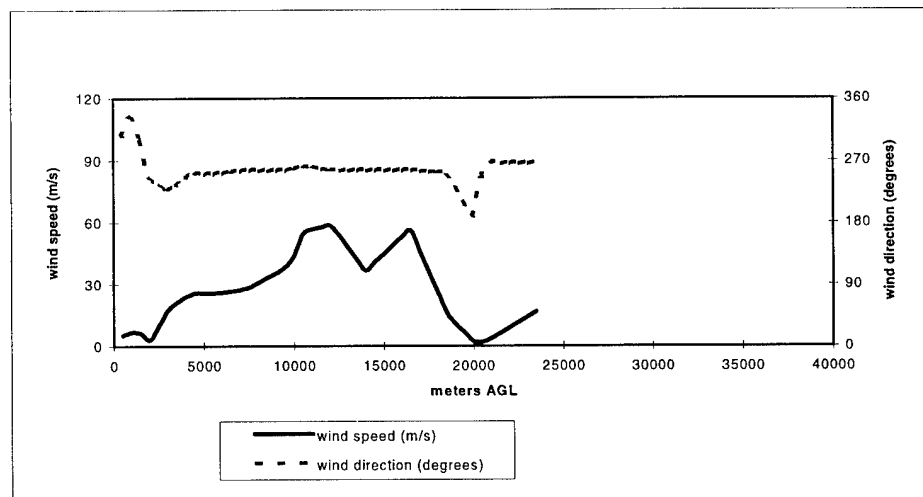
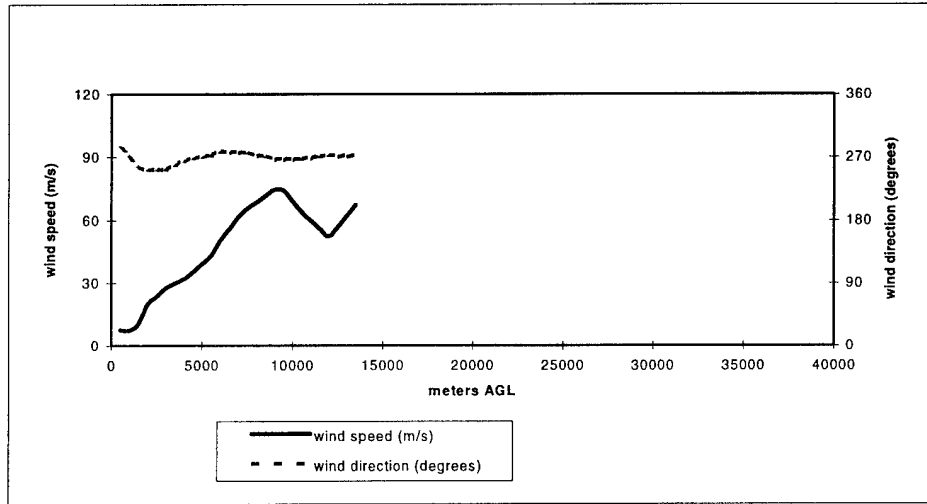
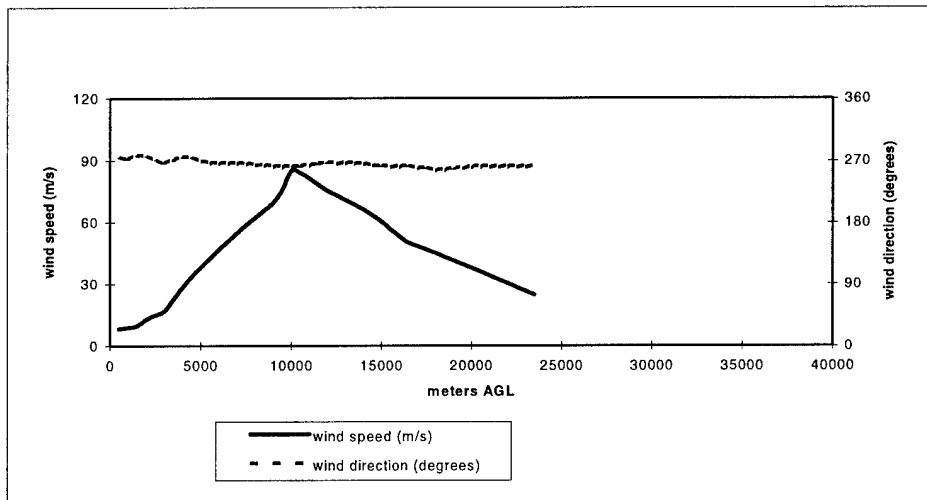


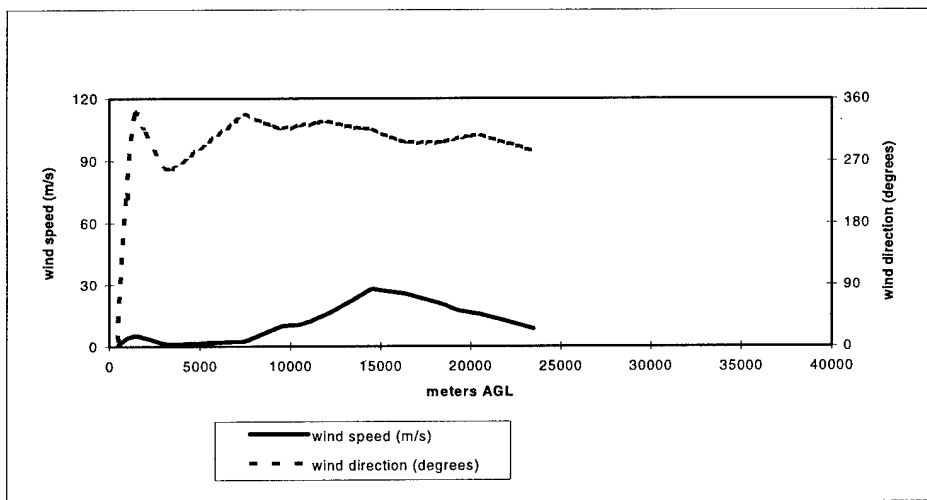
Figure 561. Bet Dagan 930227-0000



**Figure 562. Bet Dagan 930310-0000**



**Figure 563. Bet Dagan 930311-1200**



**Figure 564. Bet Dagan 930415-0600**

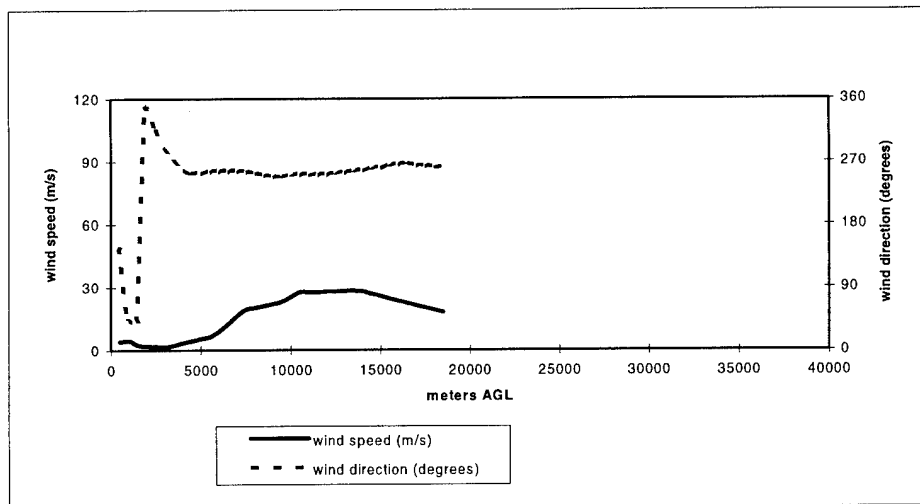


Figure 565. Bet Dagan 930422-1200

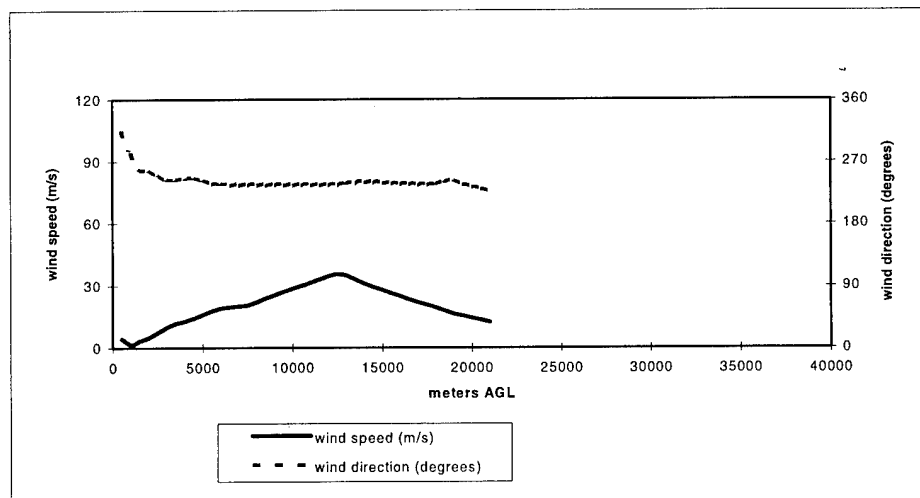


Figure 566. Bet Dagan 930527-1200

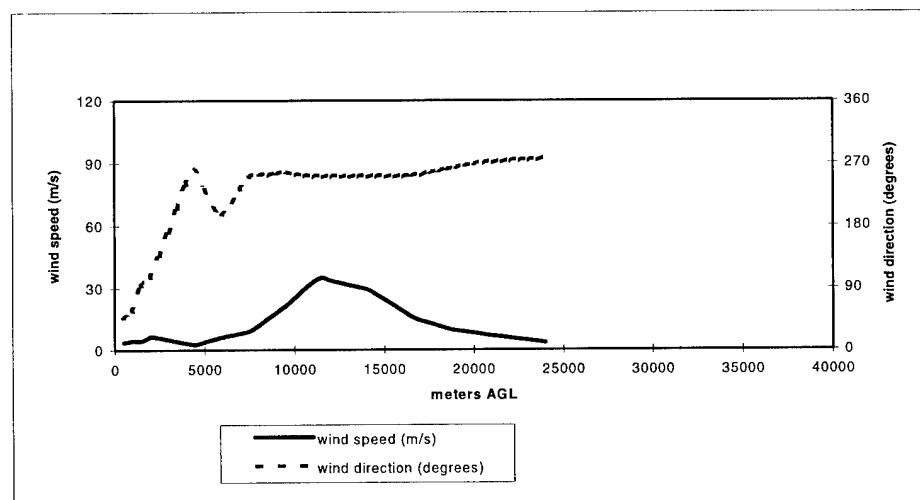
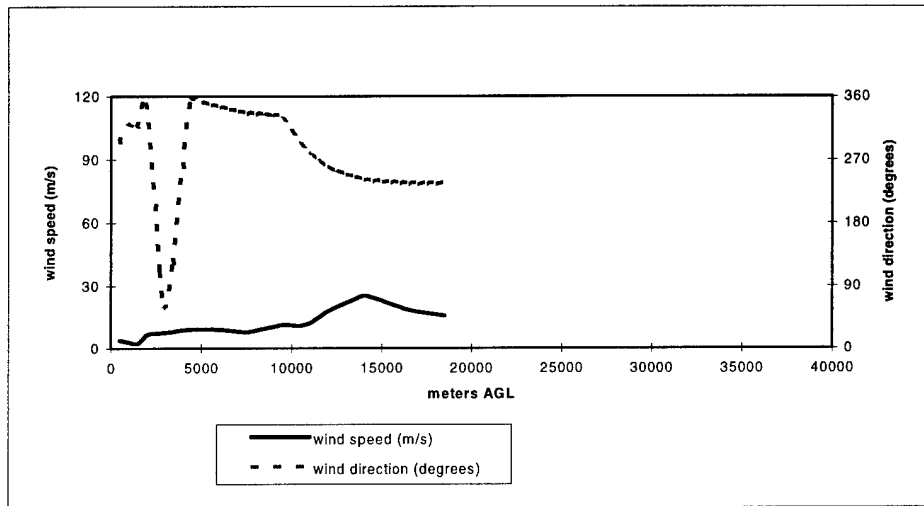
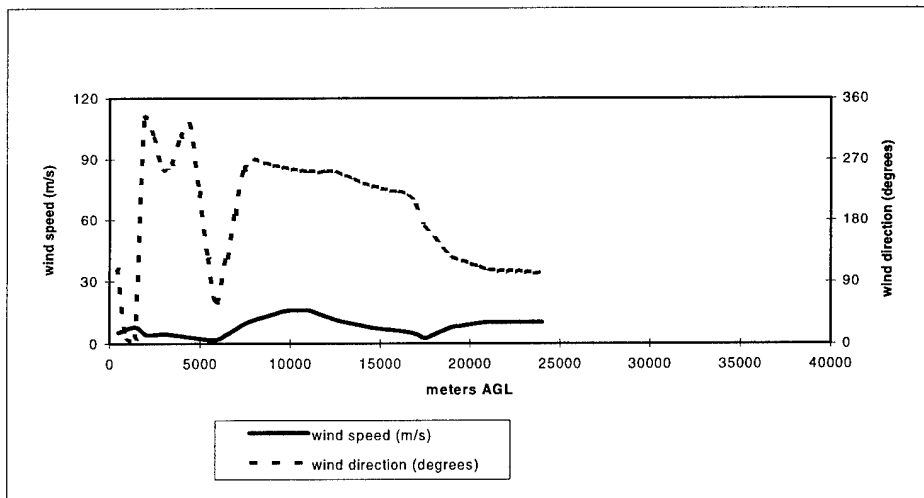


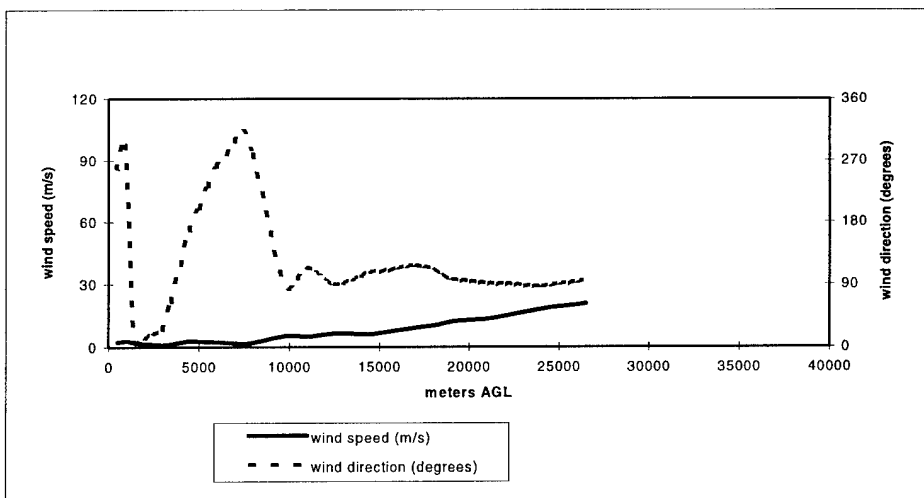
Figure 567. Bet Dagan 930529-0000



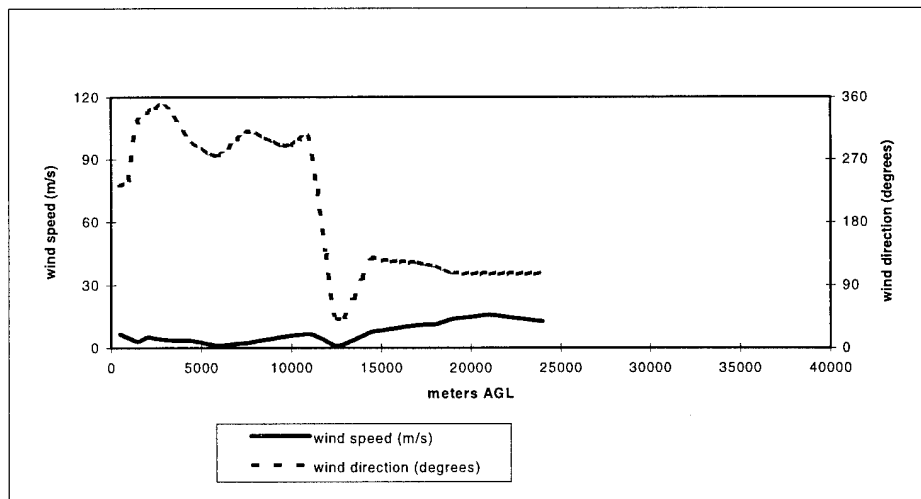
**Figure 568. Bet Dagan 930531-1200**



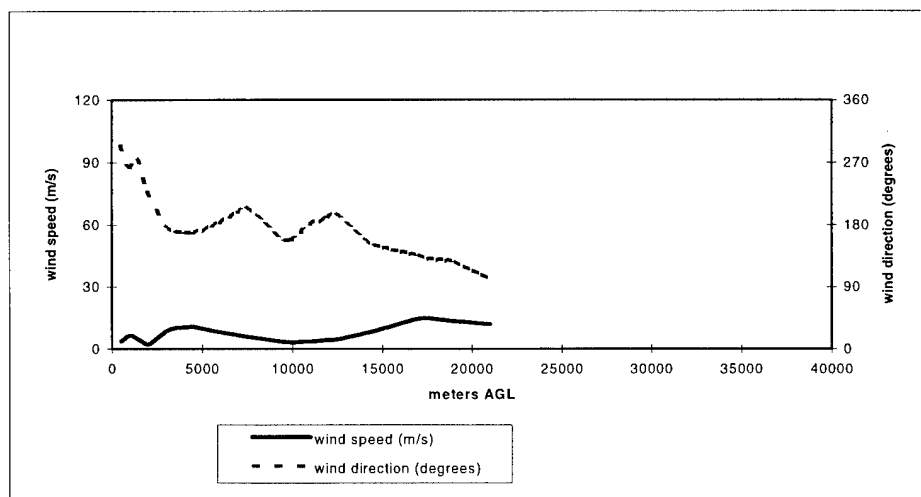
**Figure 569. Bet Dagan 930625-1200**



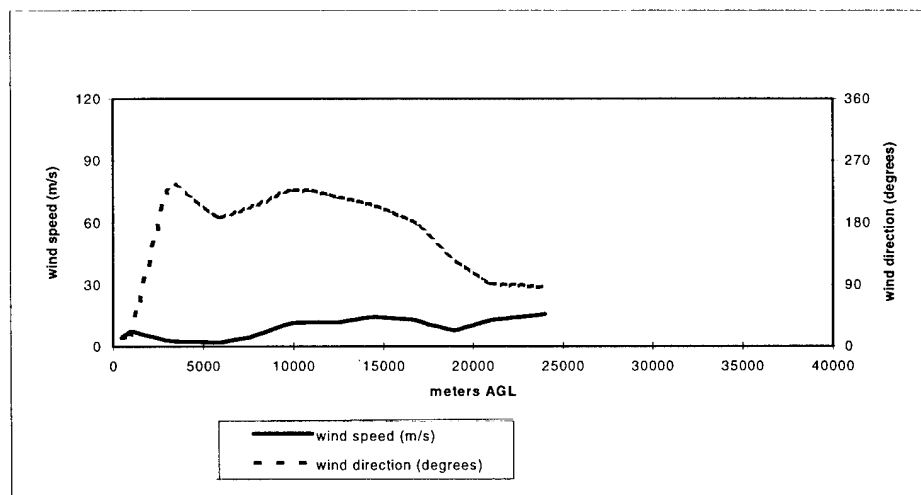
**Figure 570. Bet Dagan 930720-0000**



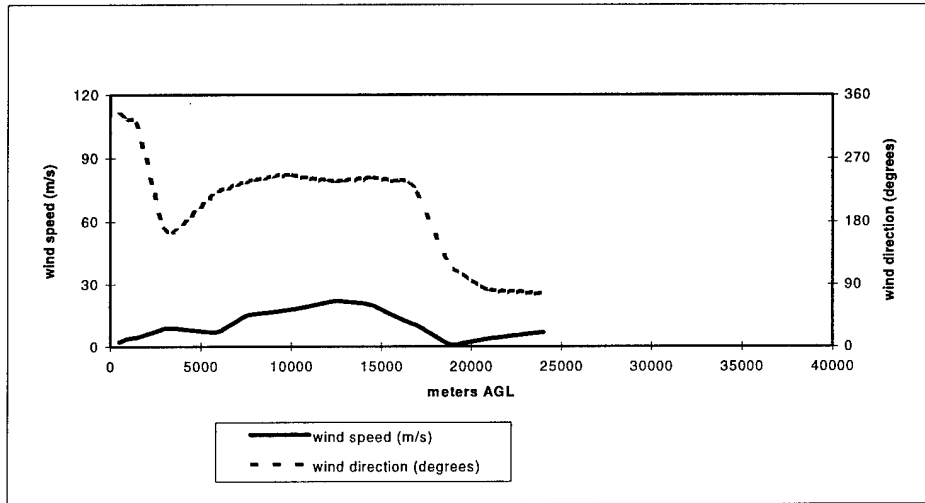
**Figure 571. Bet Dagan 930724-1200**



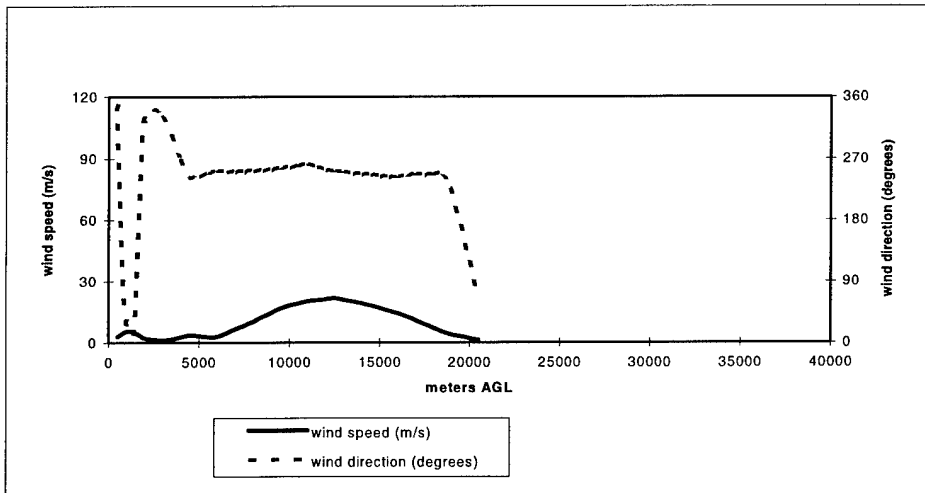
**Figure 572. Bet Dagan 930726-1800**



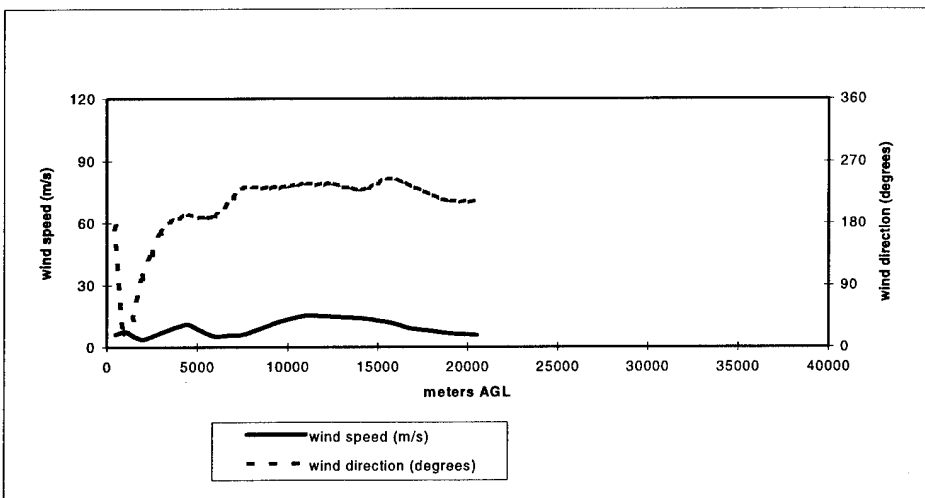
**Figure 573. Bet Dagan 930814-1800**



**Figure 574. Bet Dagan 930911-0000**



**Figure 575. Bet Dagan 930914-0000**



**Figure 576. Bet Dagan 930915-1200**



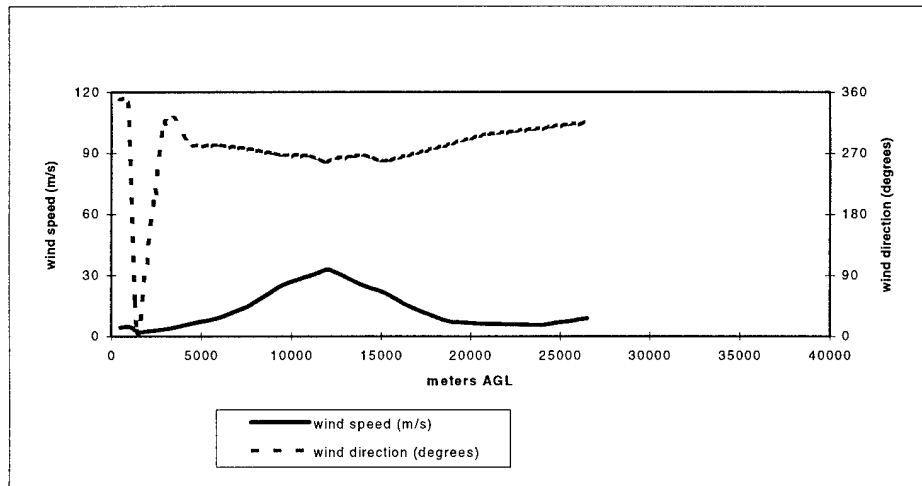


Figure 577. Bet Dagan 930925-1800

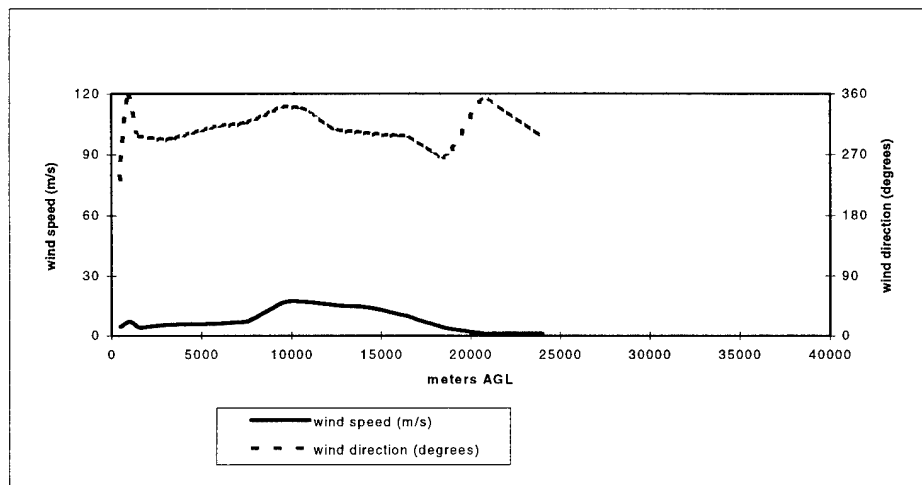


Figure 578. Bet Dagan 930928-0000

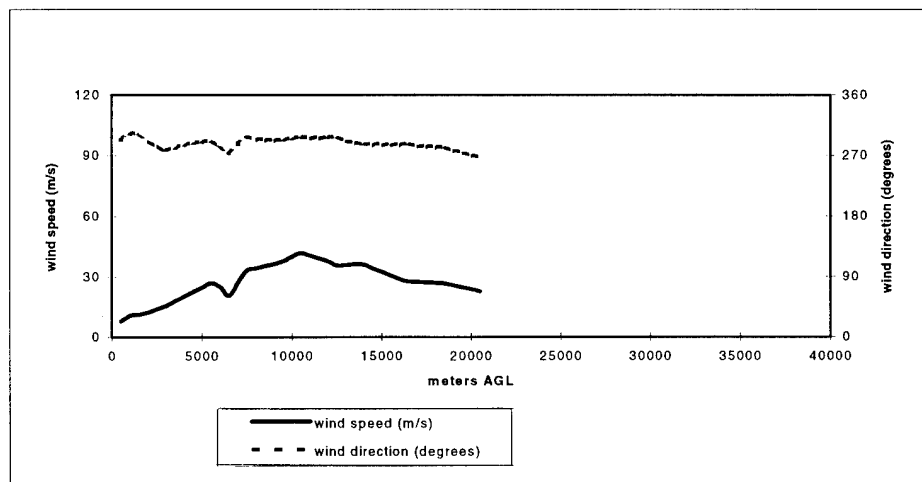
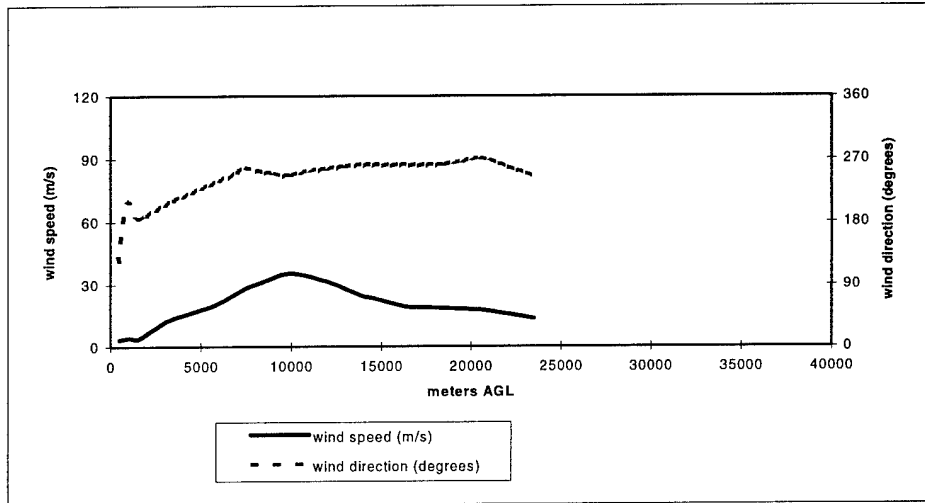
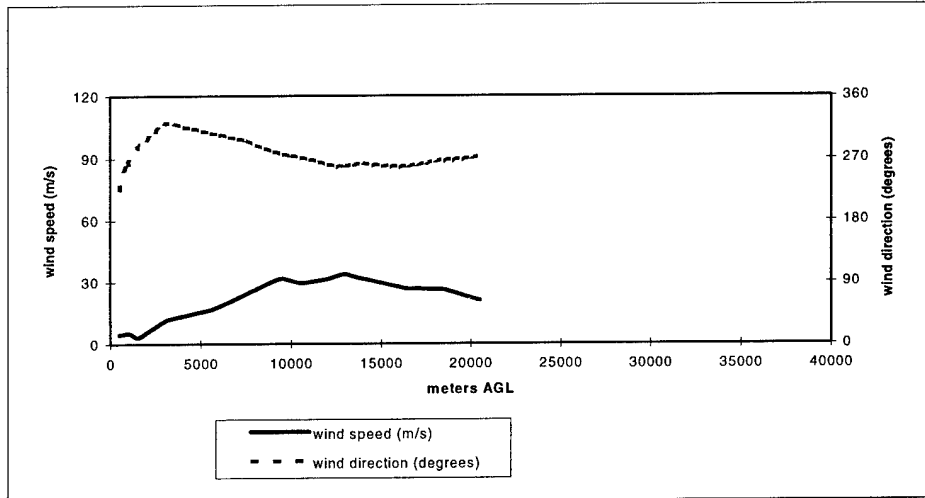


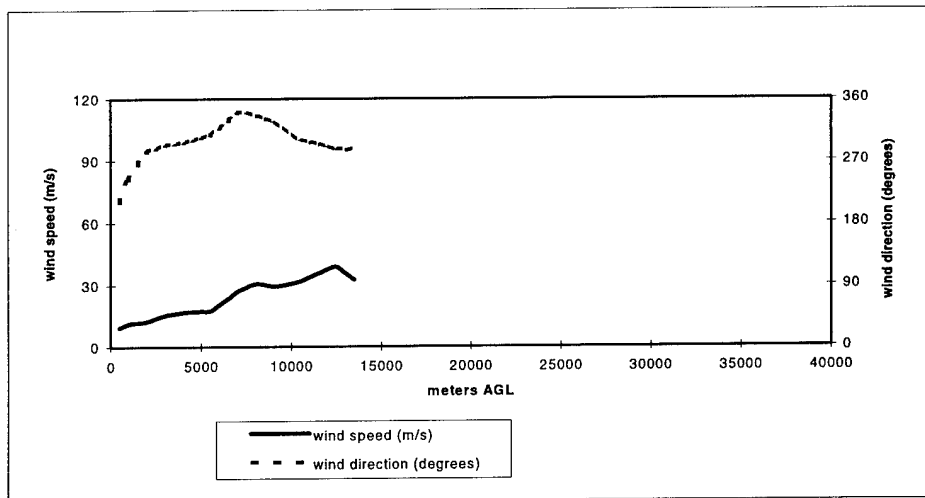
Figure 579. Bet Dagan 931112-0000



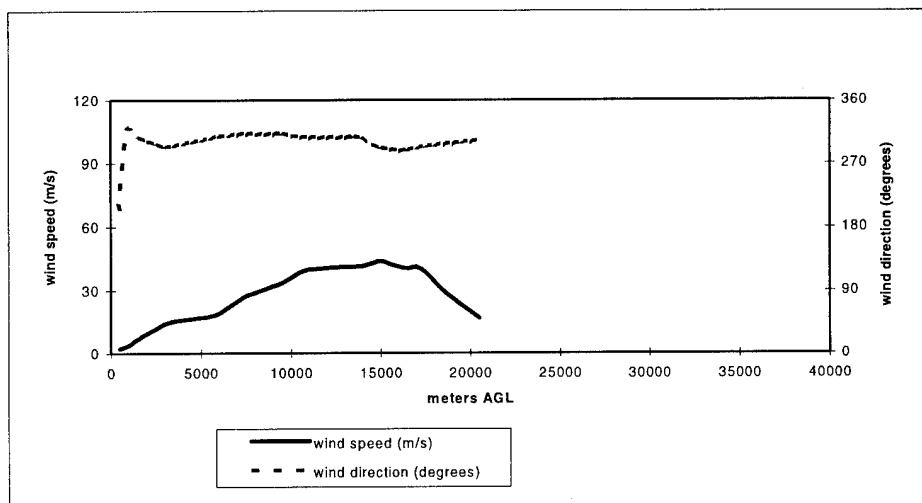
**Figure 580. Bet Dagan 931121-0600**



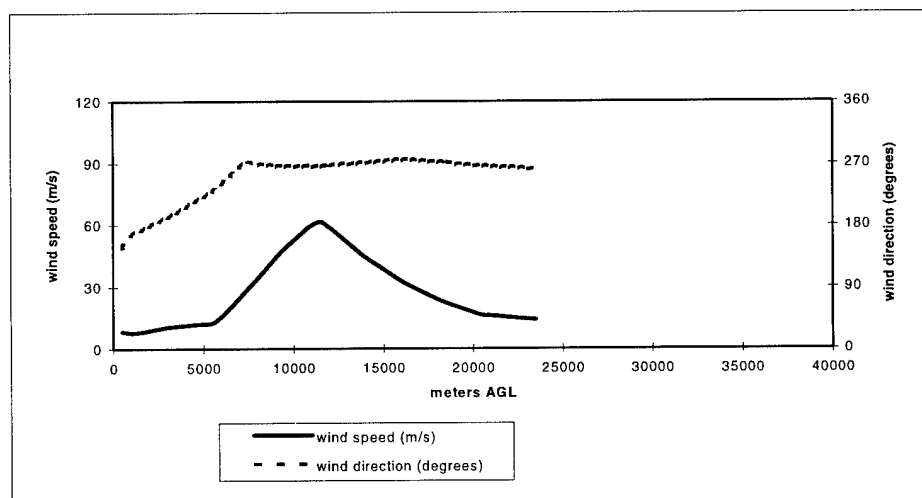
**Figure 581. Bet Dagan 940105-0600**



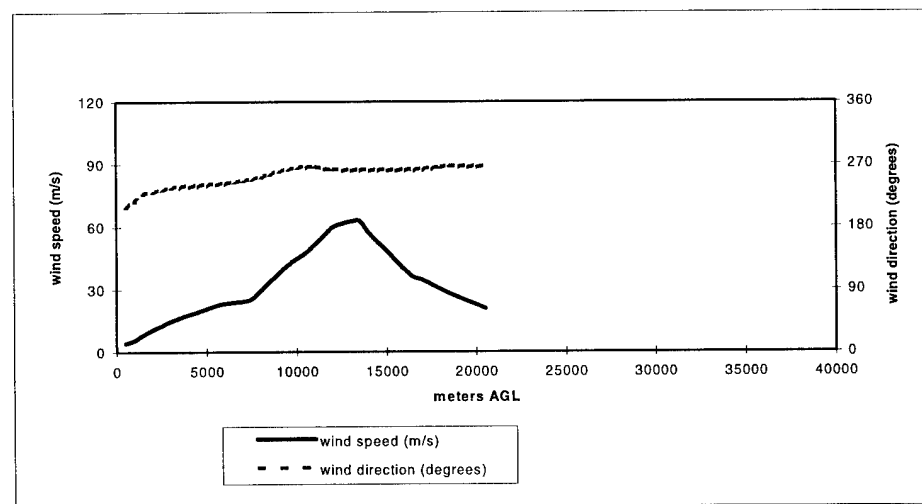
**Figure 582. Bet Dagan 940116-0000**



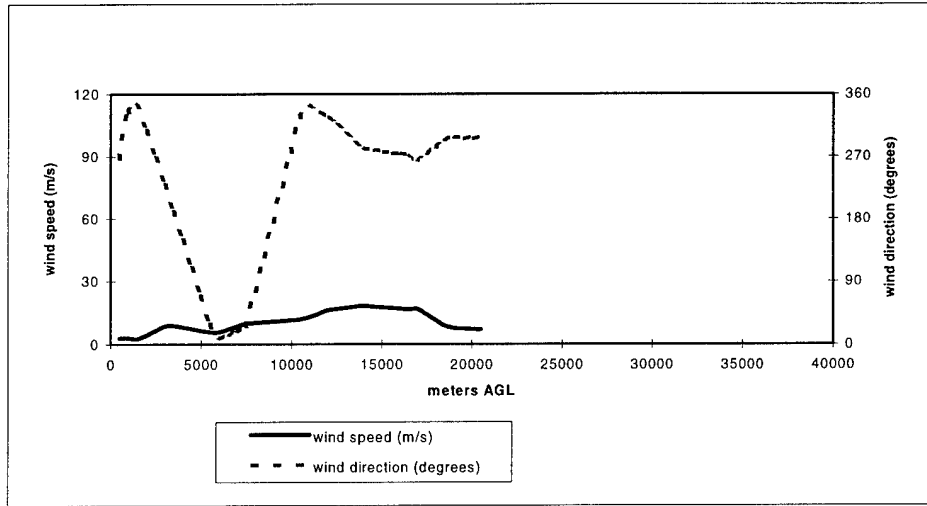
**Figure 583. Bet Dagan 940120-0600**



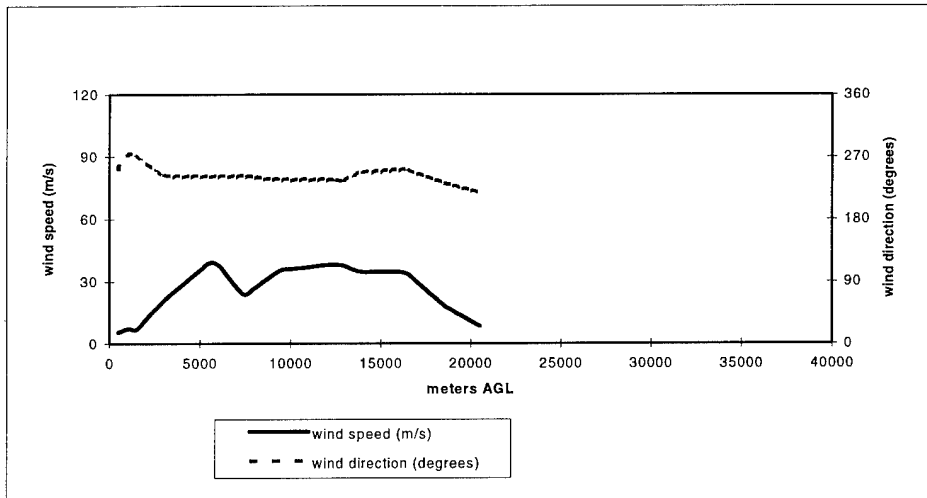
**Figure 584. Bet Dagan 940127-1200**



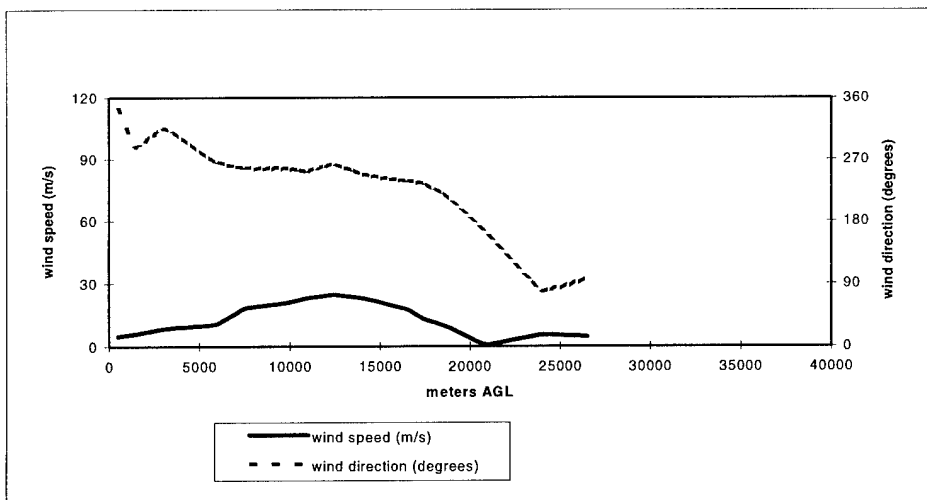
**Figure 585. Bet Dagan 940207-1200**



**Figure 586. Bet Dagan 940416-1200**



**Figure 587. Bet Dagan 940423-1200**



**Figure 588. Bet Dagan 940615-1800**

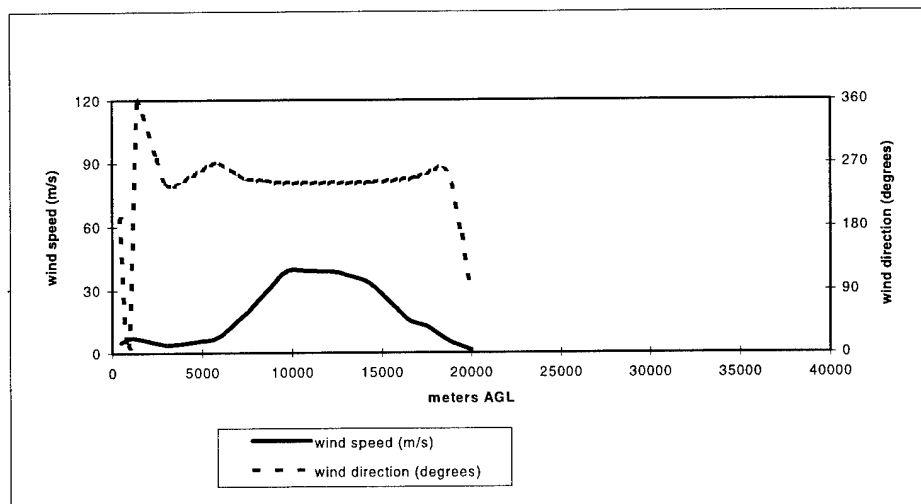


Figure 589. Bet Dagan 940619-1800

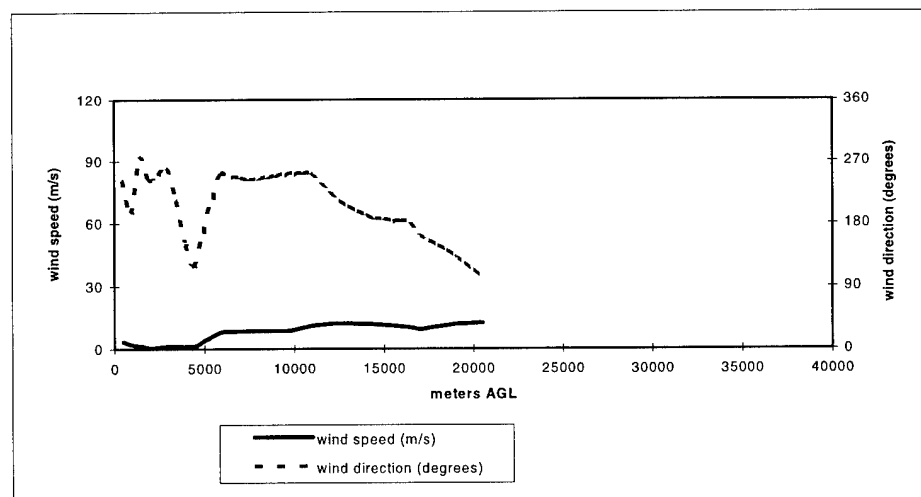


Figure 590. Bet Dagan 940705-1200

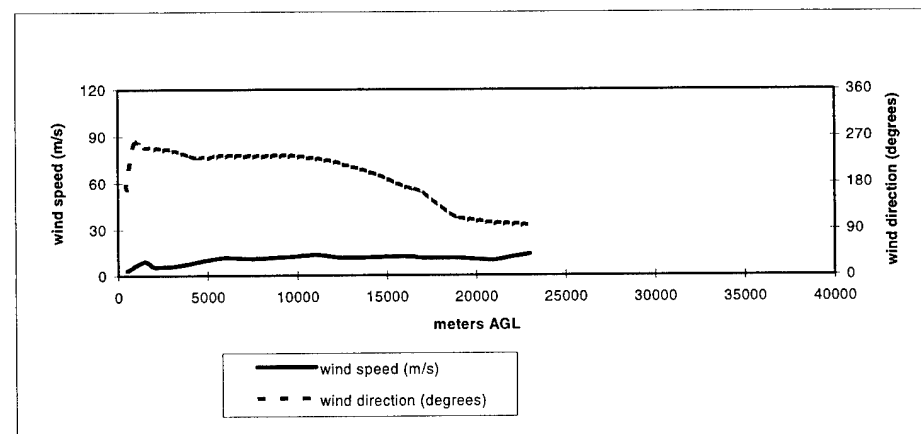


Figure 591. Bet Dagan 940807-0000

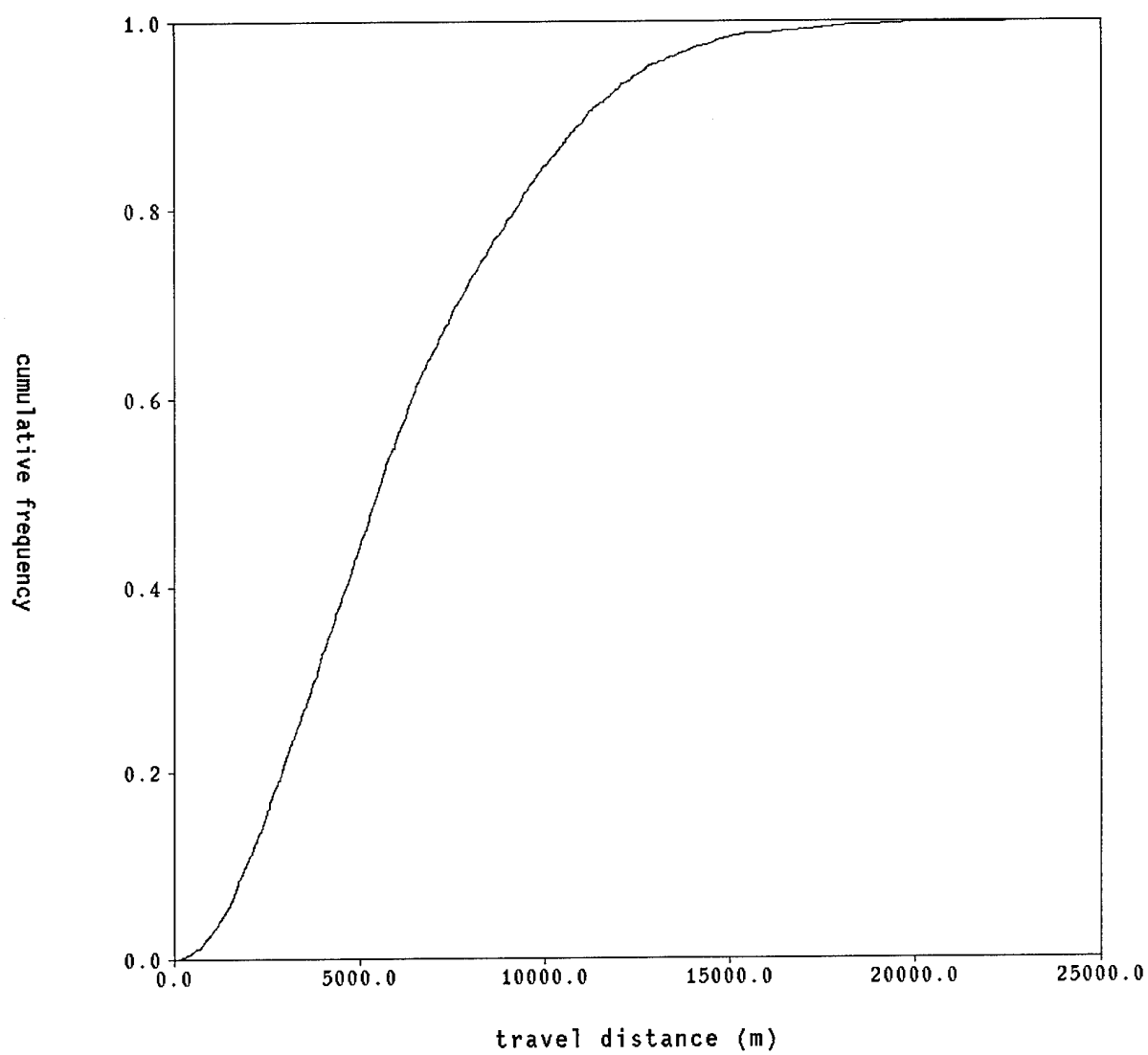
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## **APPENDIX A**

### **CUMULATIVE FREQUENCY DISTRIBUTIONS FOR TRAVEL AND SPREAD DISTANCES**

At each of the ten stations considered in this report and at each of the four intercept altitudes, the simulation of each applicable vertical wind profile generates a travel distance and a spread distance (defined in the body of the report), resulting in (usually) hundreds of observations for each station/altitude combination.

This appendix illustrates the resulting sets of travel distances and spread distances for each combination in the form of cumulative frequency distributions. In each figure, each x-y point on the curve indicates that for the case shown, approximately  $y \times 100\%$  of the observations are less than or equal to x, i.e., y is the probability that an observation is less than or equal to x.



**Figure A-1. Travel Distance, Fritzlar, 5 km**



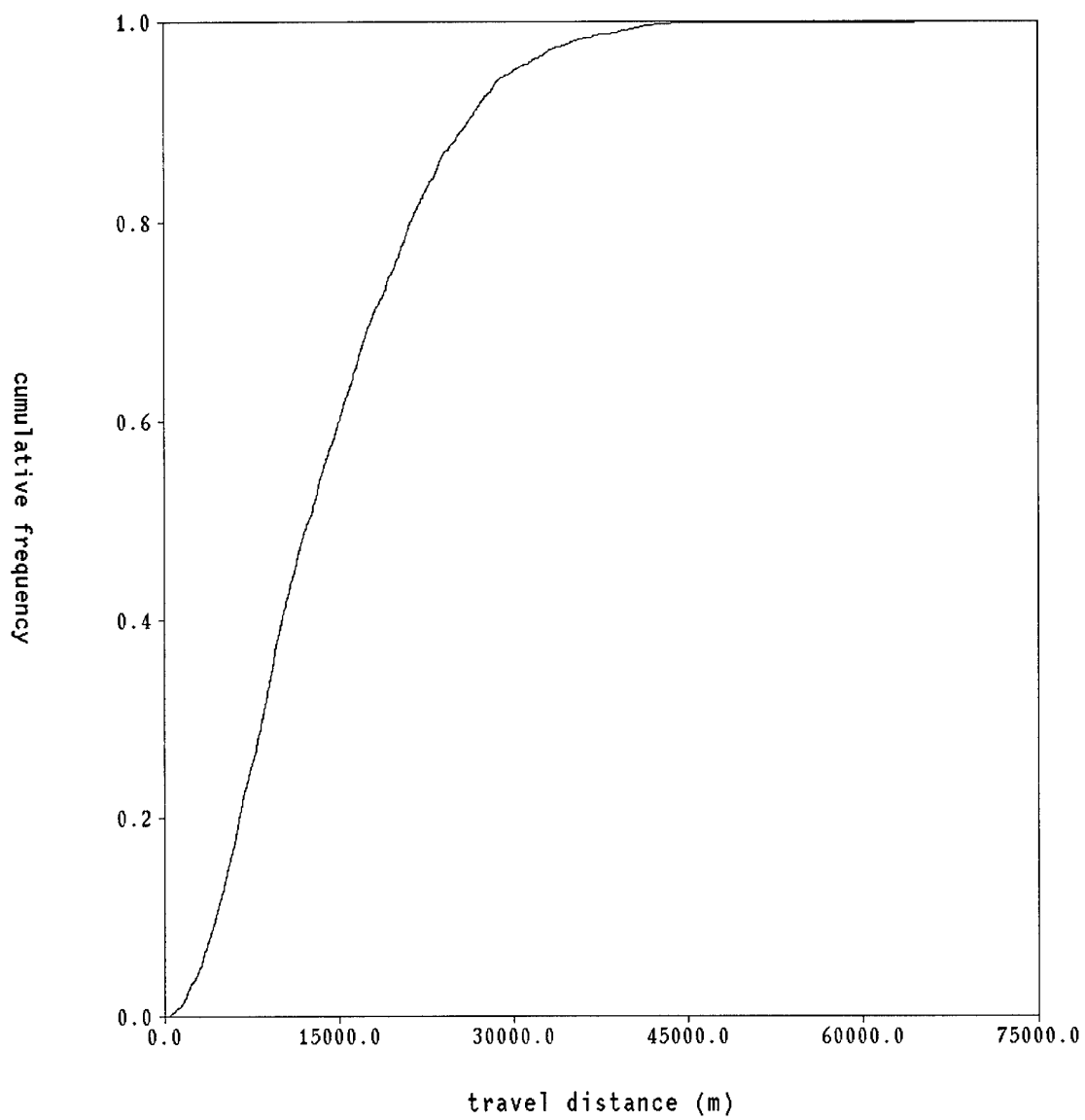
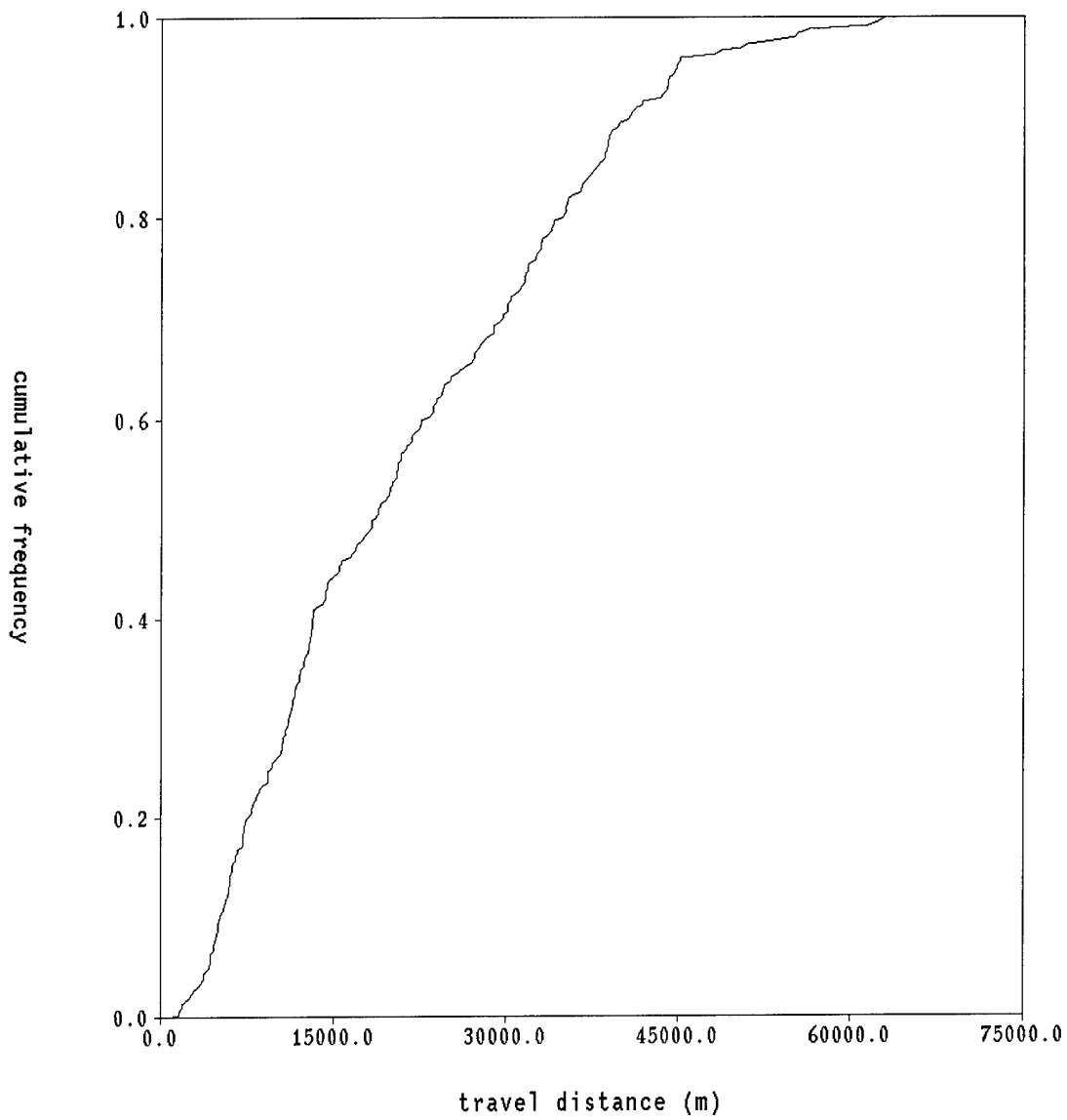
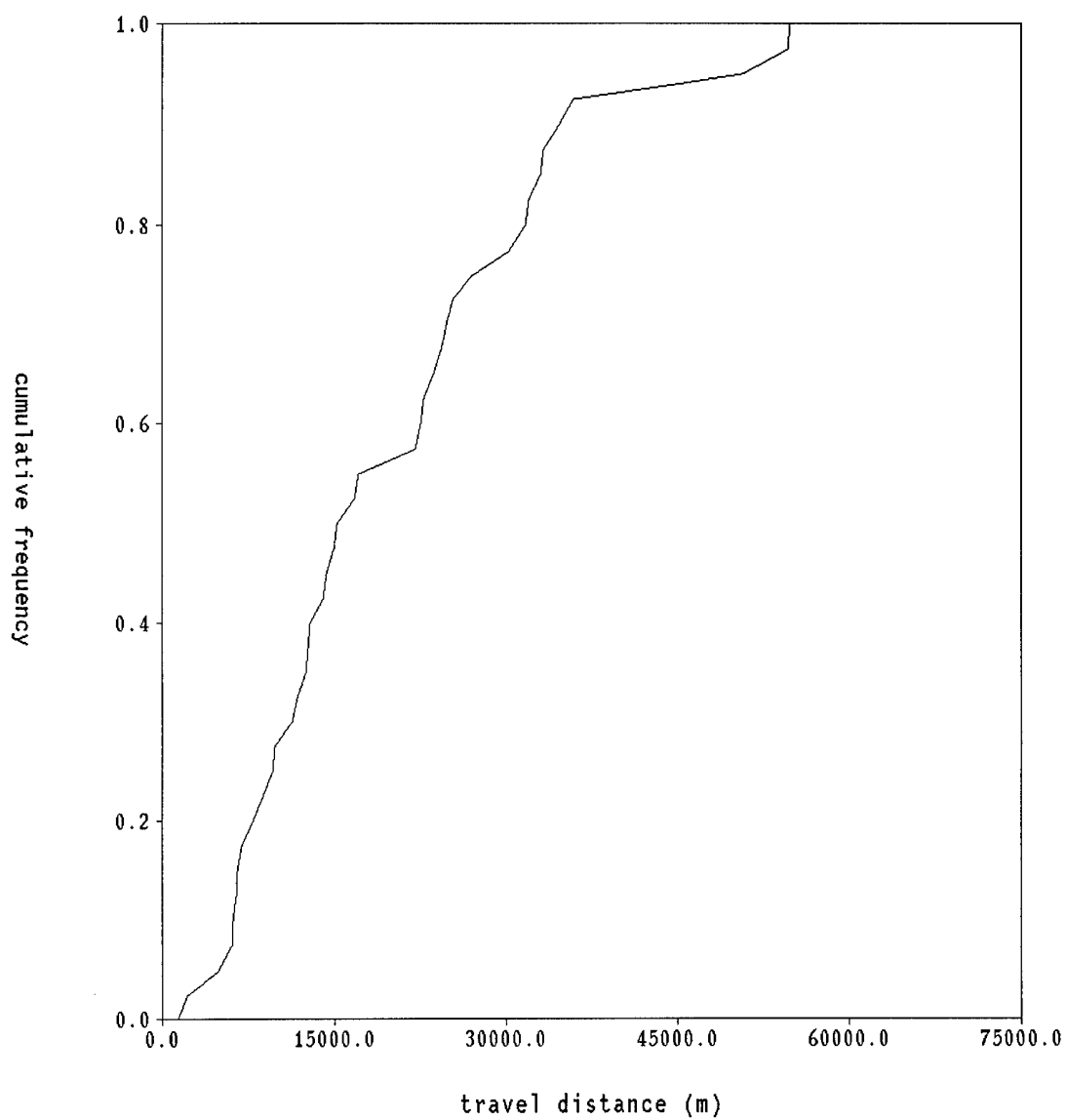


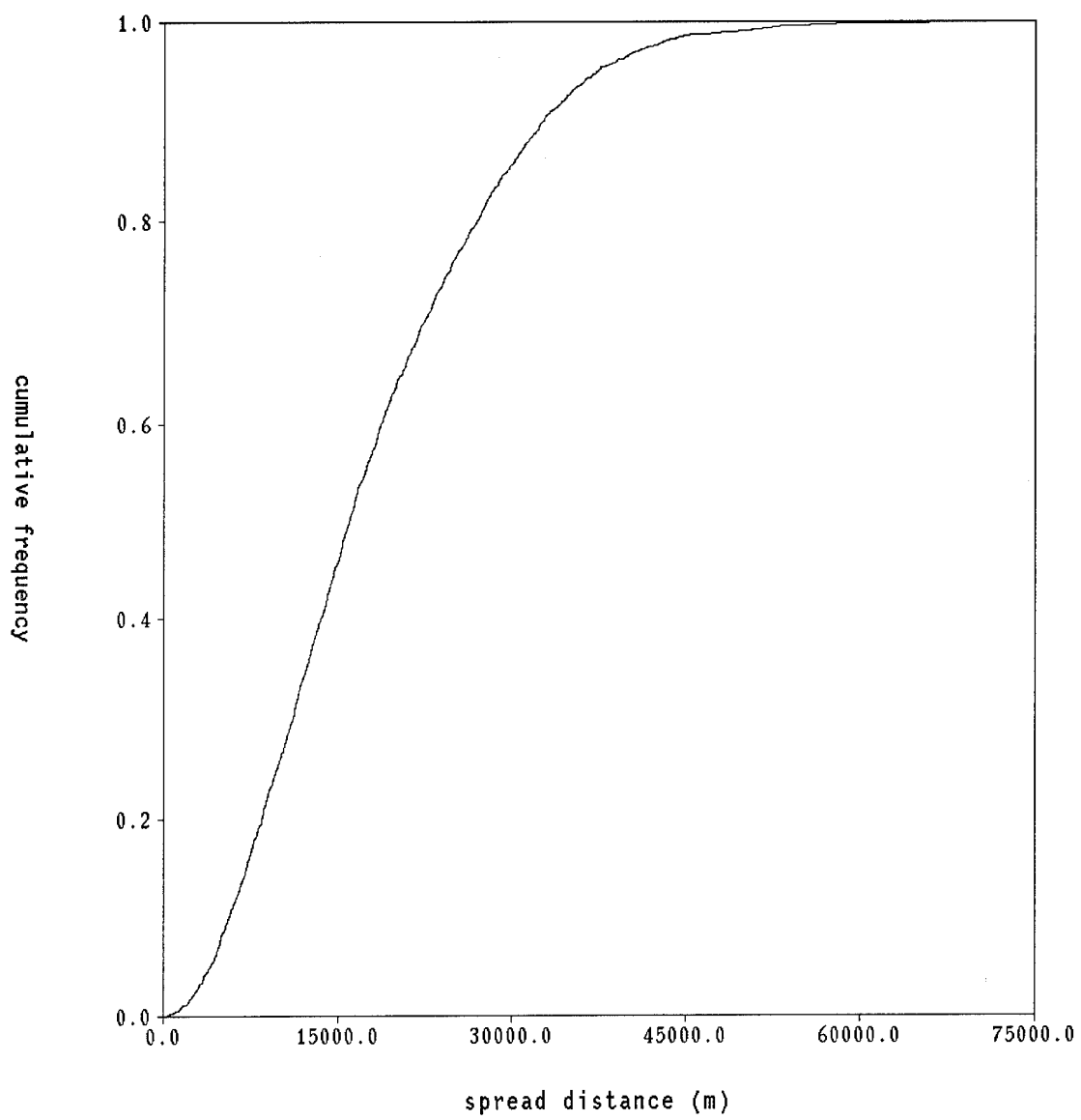
Figure A-2. Travel Distance, Fritzlar, 10 km



**Figure A-3. Travel Distance, Fritzlar, 20 km**



**Figure A-4. Travel Distance, Fritzlar, 30 km**



**Figure A-5. Spread Distance, Fritzlar, 5 km**

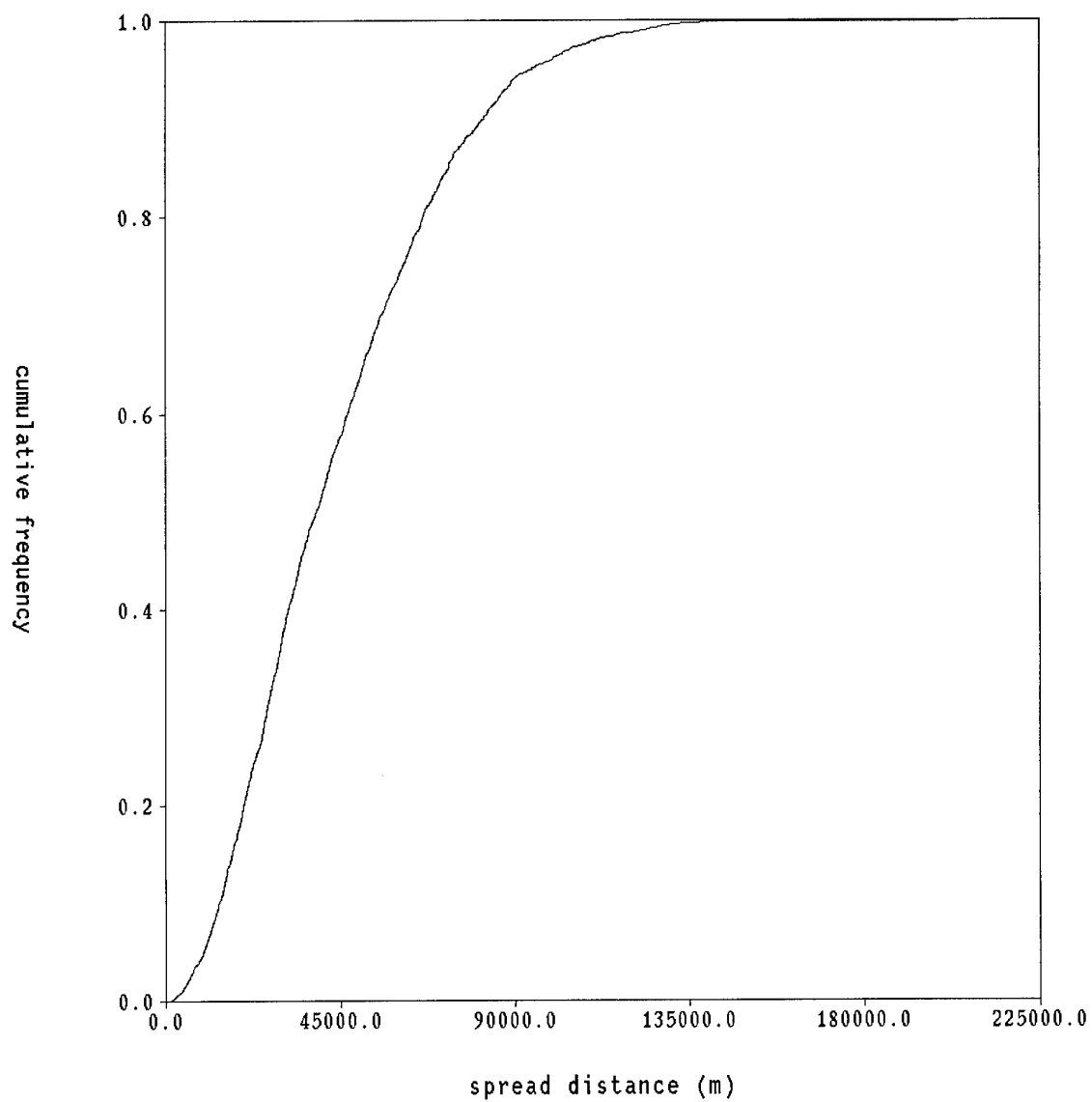
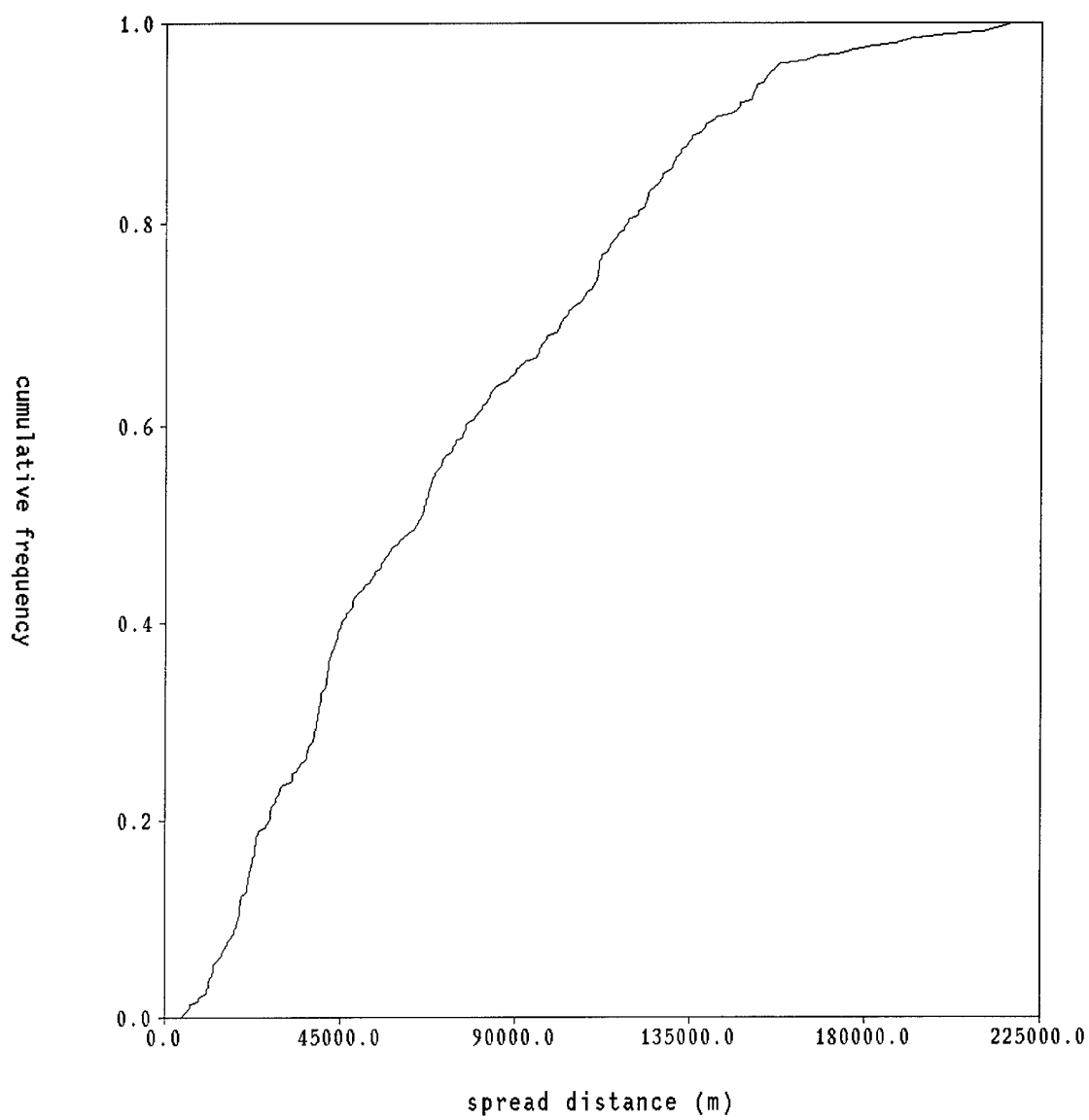
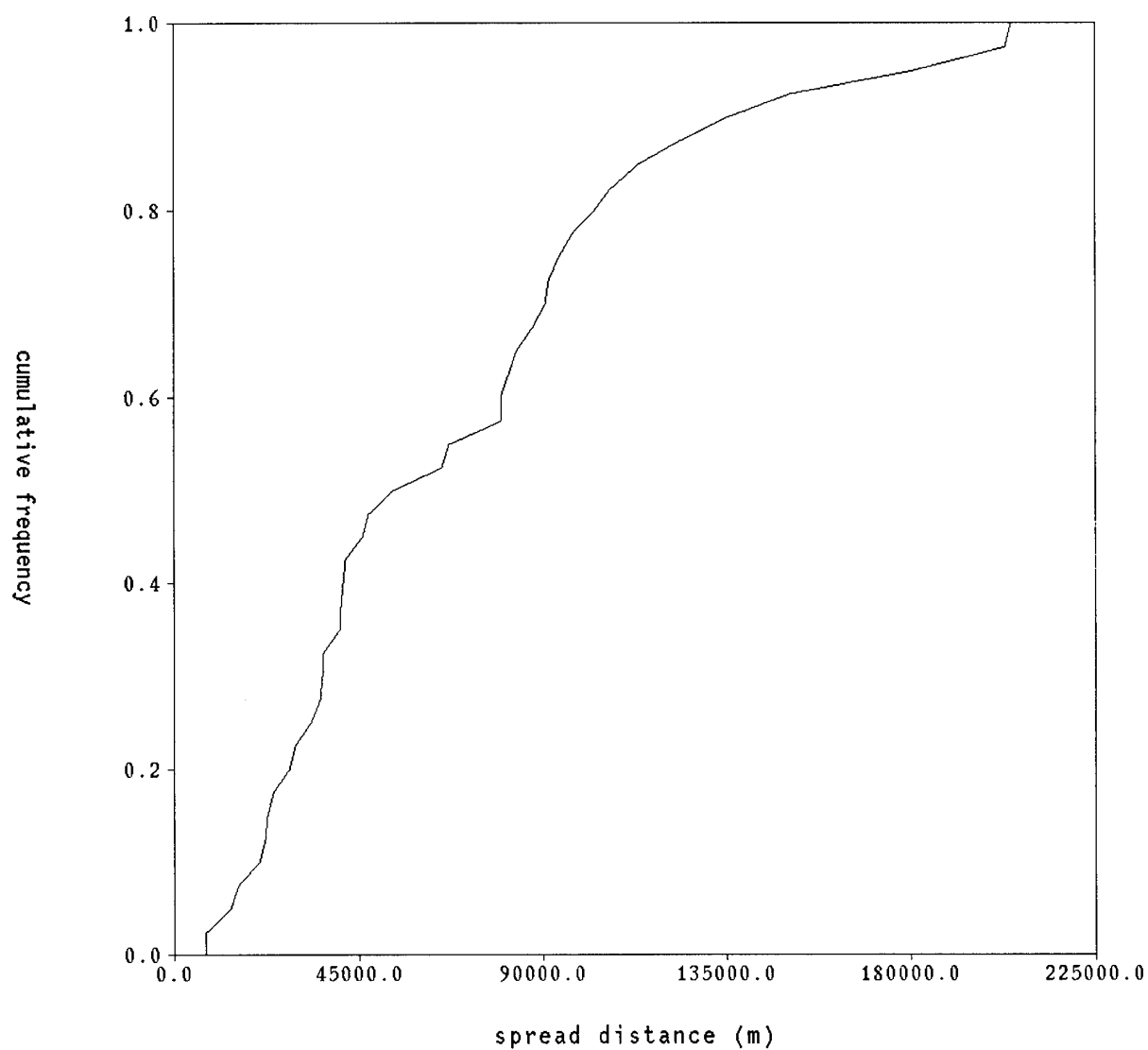


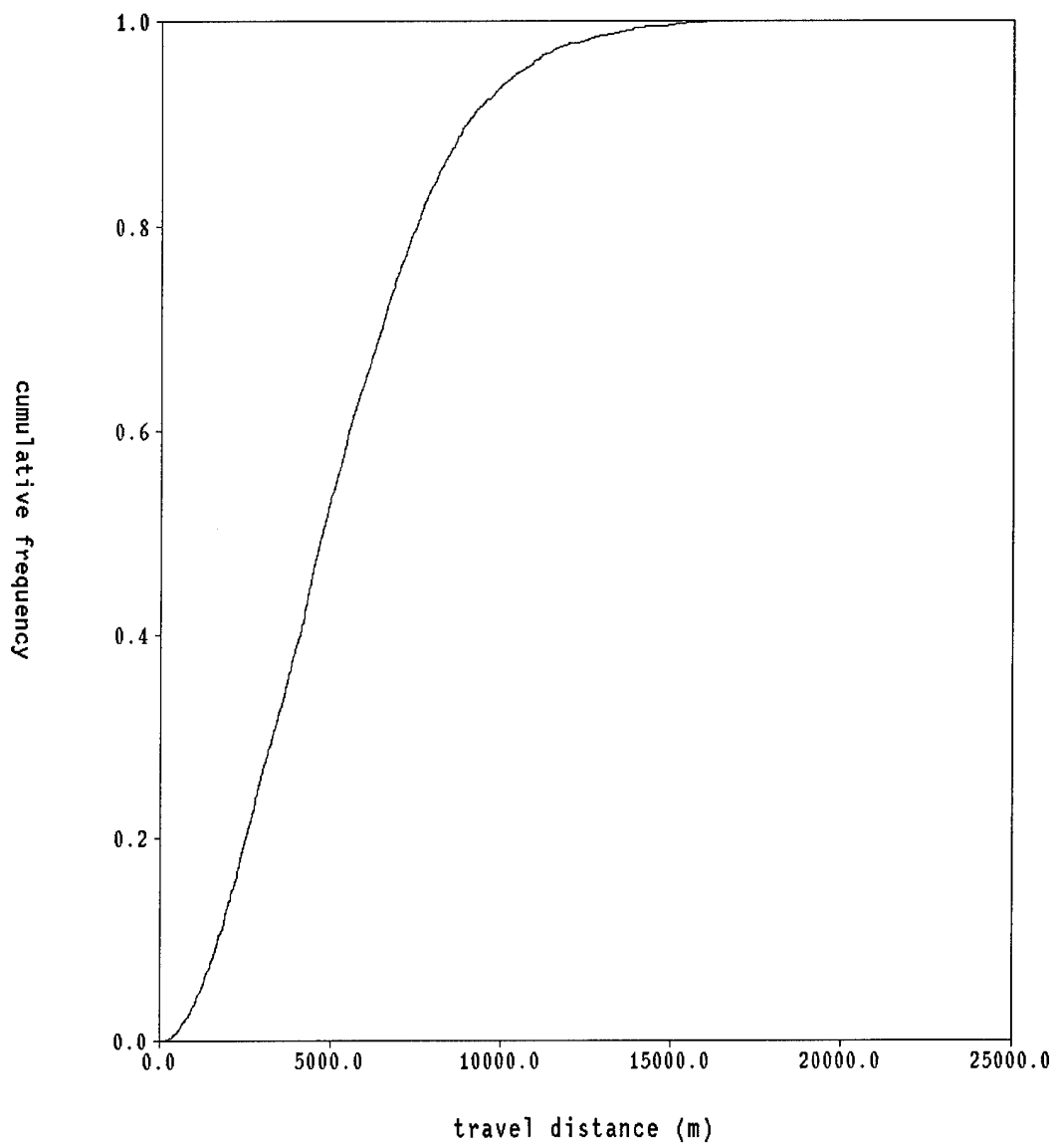
Figure A-6. Spread Distance, Fritzlar, 10 km



**Figure A-7. Spread Distance, Fritzlar, 20 km**

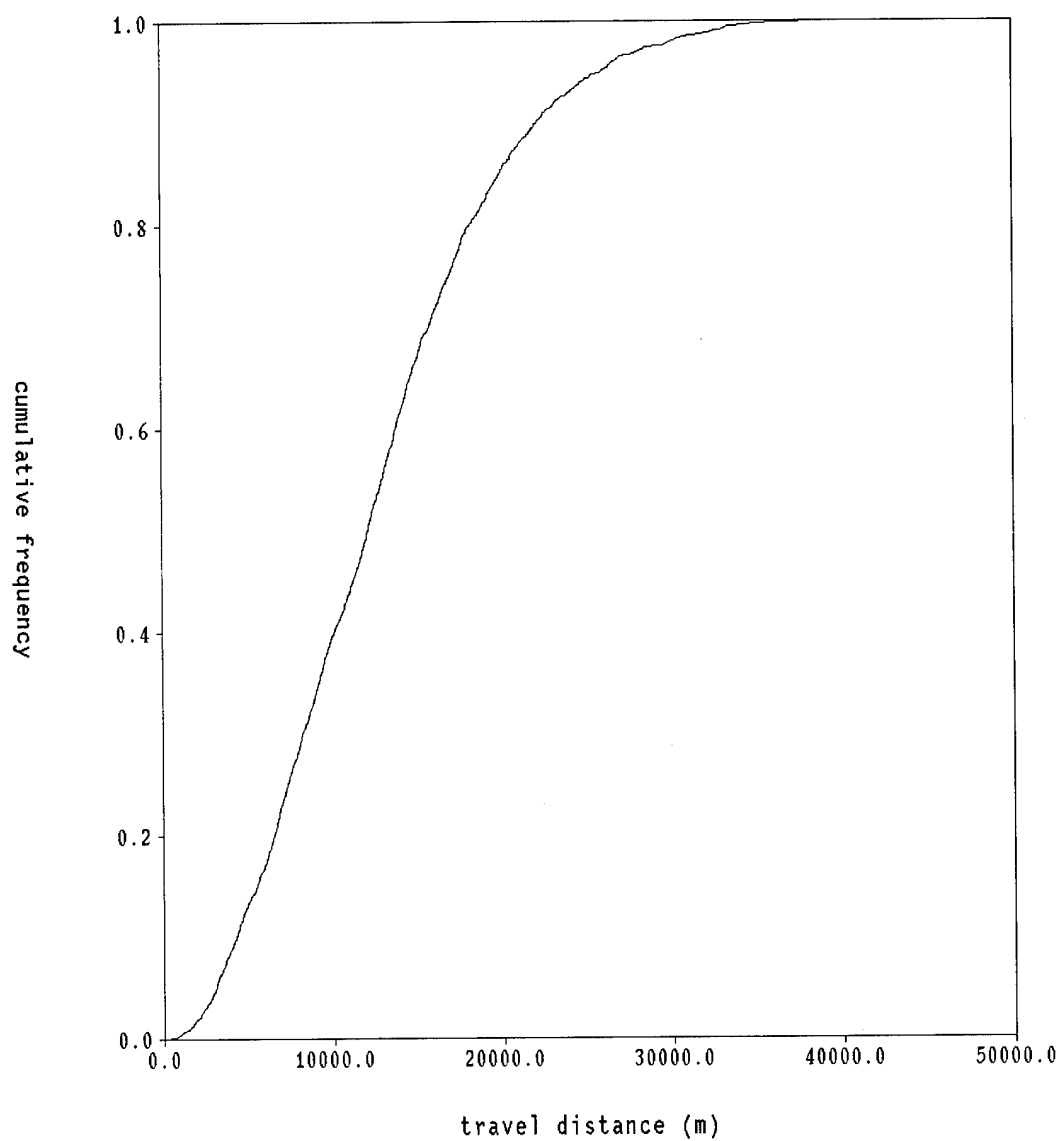


**Figure A-8. Spread Distance, Fritzlar, 30 km**

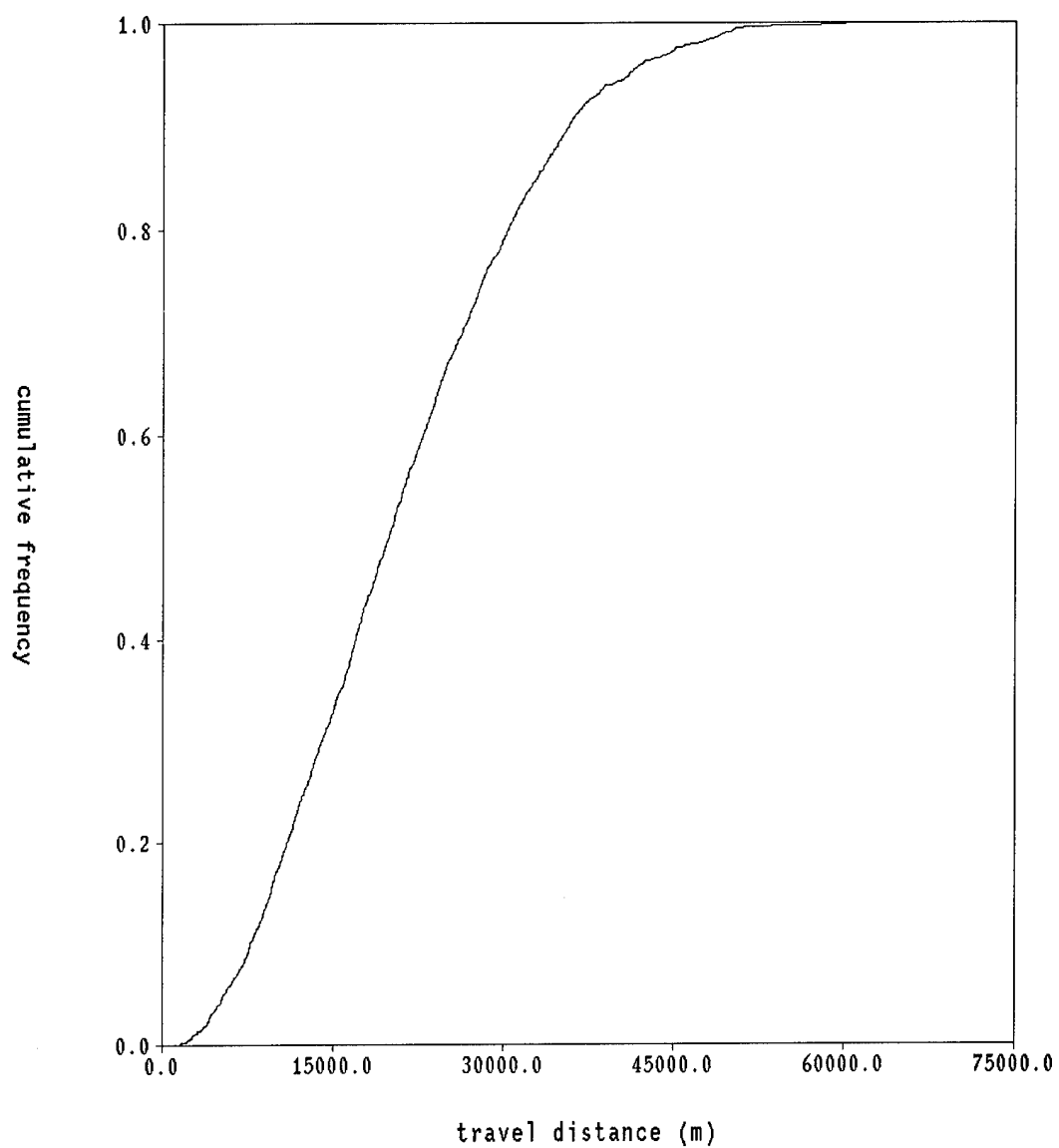


**Figure A-9. Travel Distance, Trapani, 5 km**

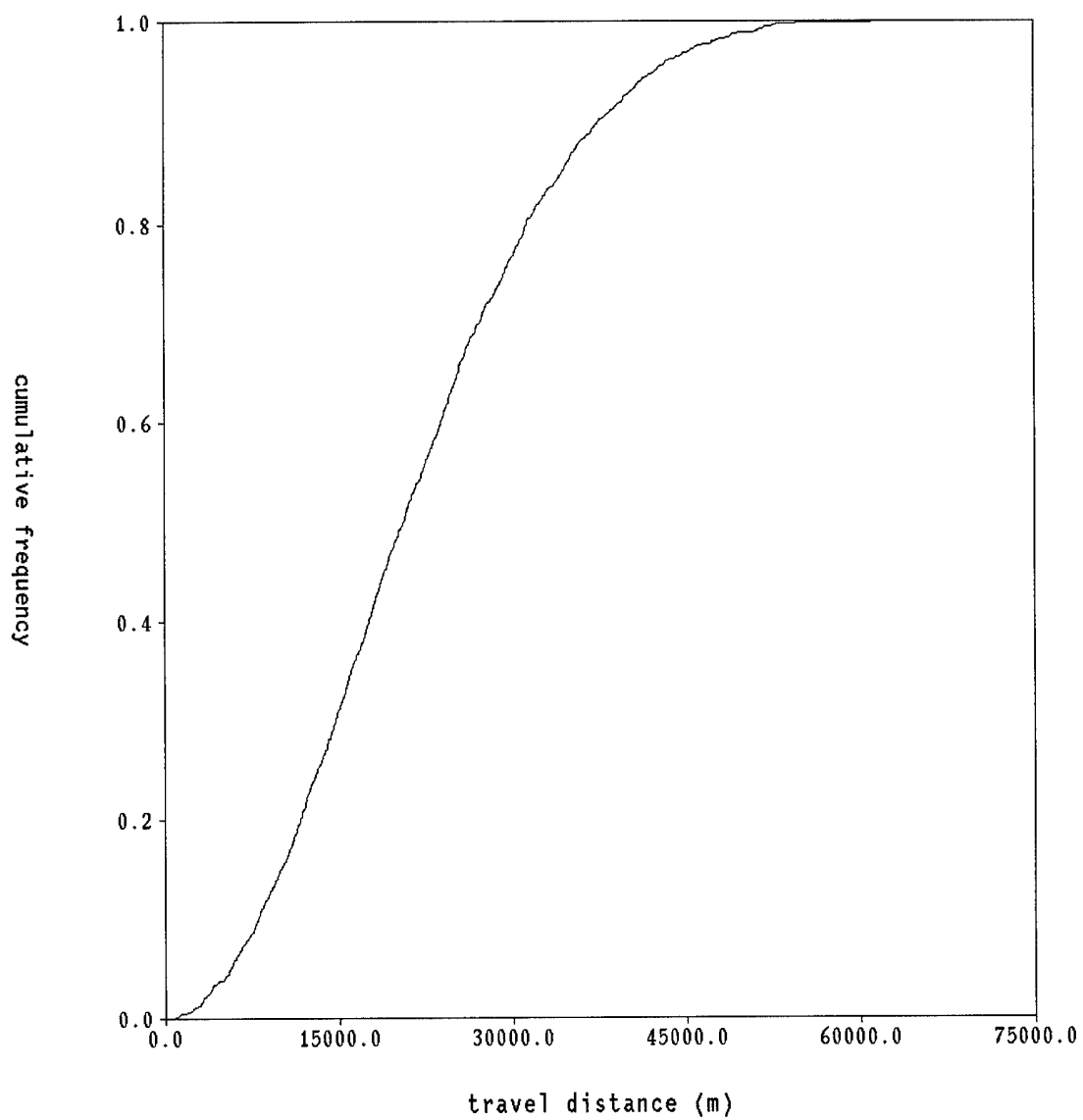




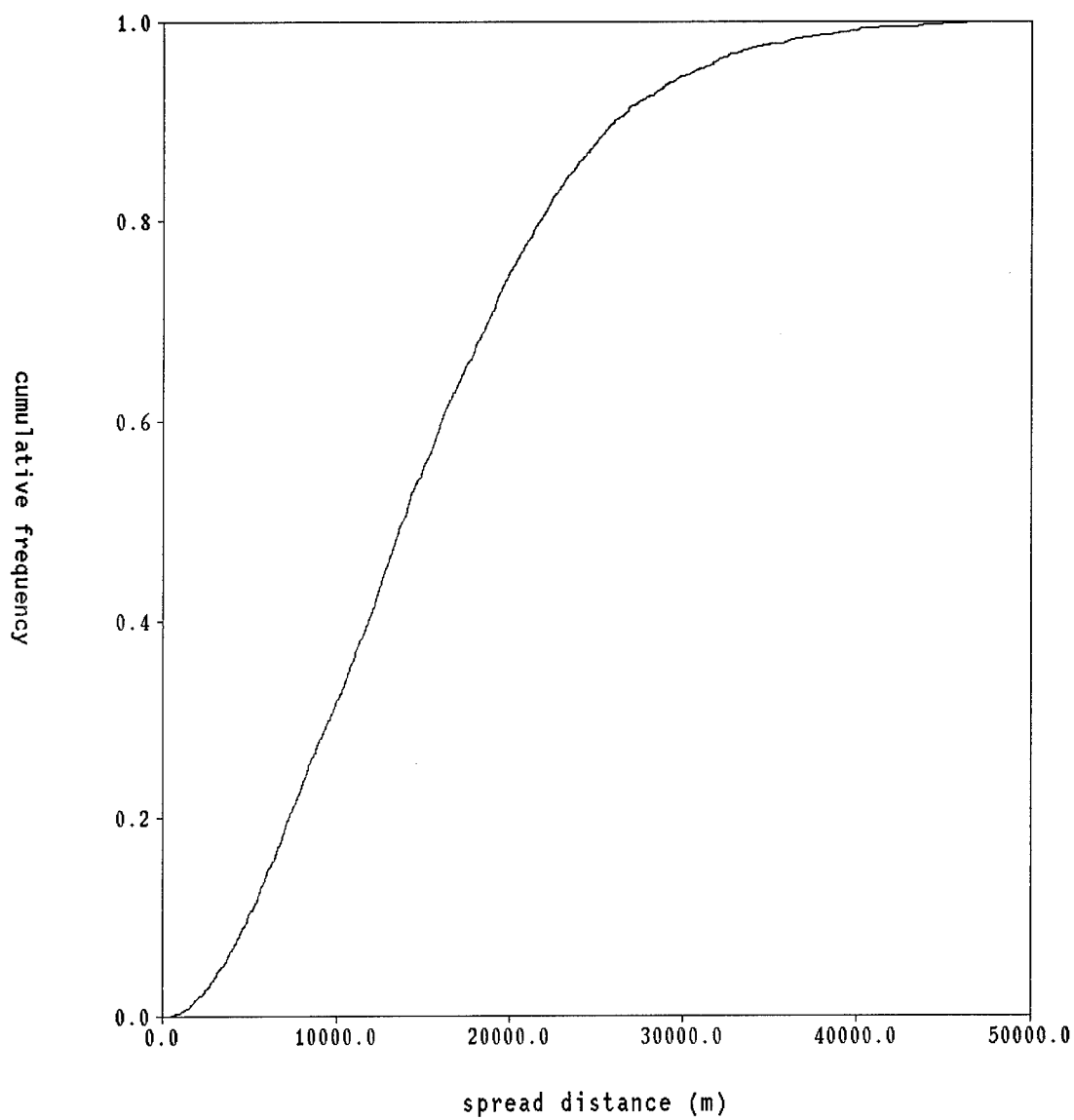
**Figure A-10. Travel Distance, Trapani, 10 km**



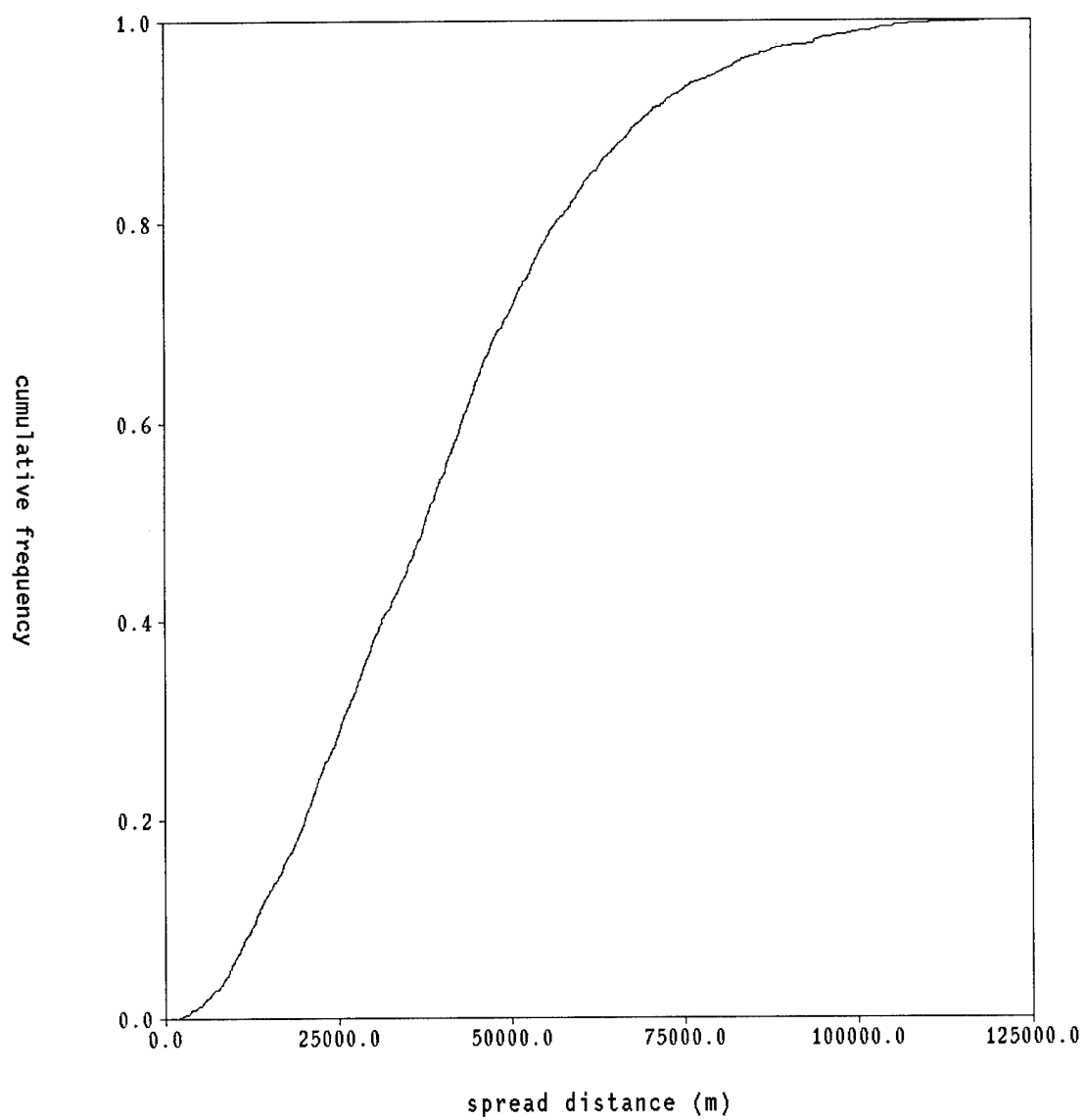
**Figure A-11. Travel Distance, Trapani, 20 km**



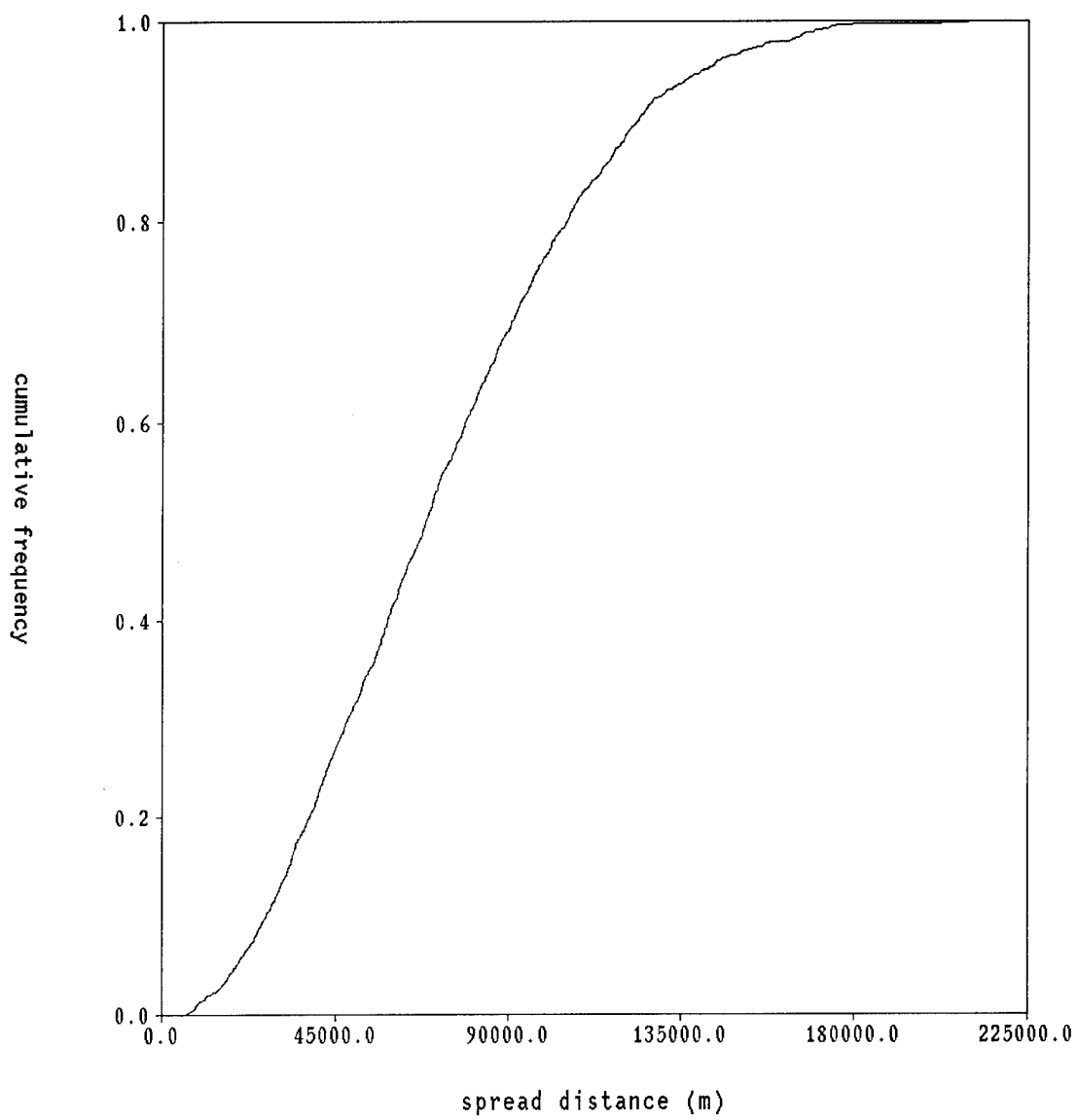
**Figure A-12. Travel Distance, Trapani, 30 km**



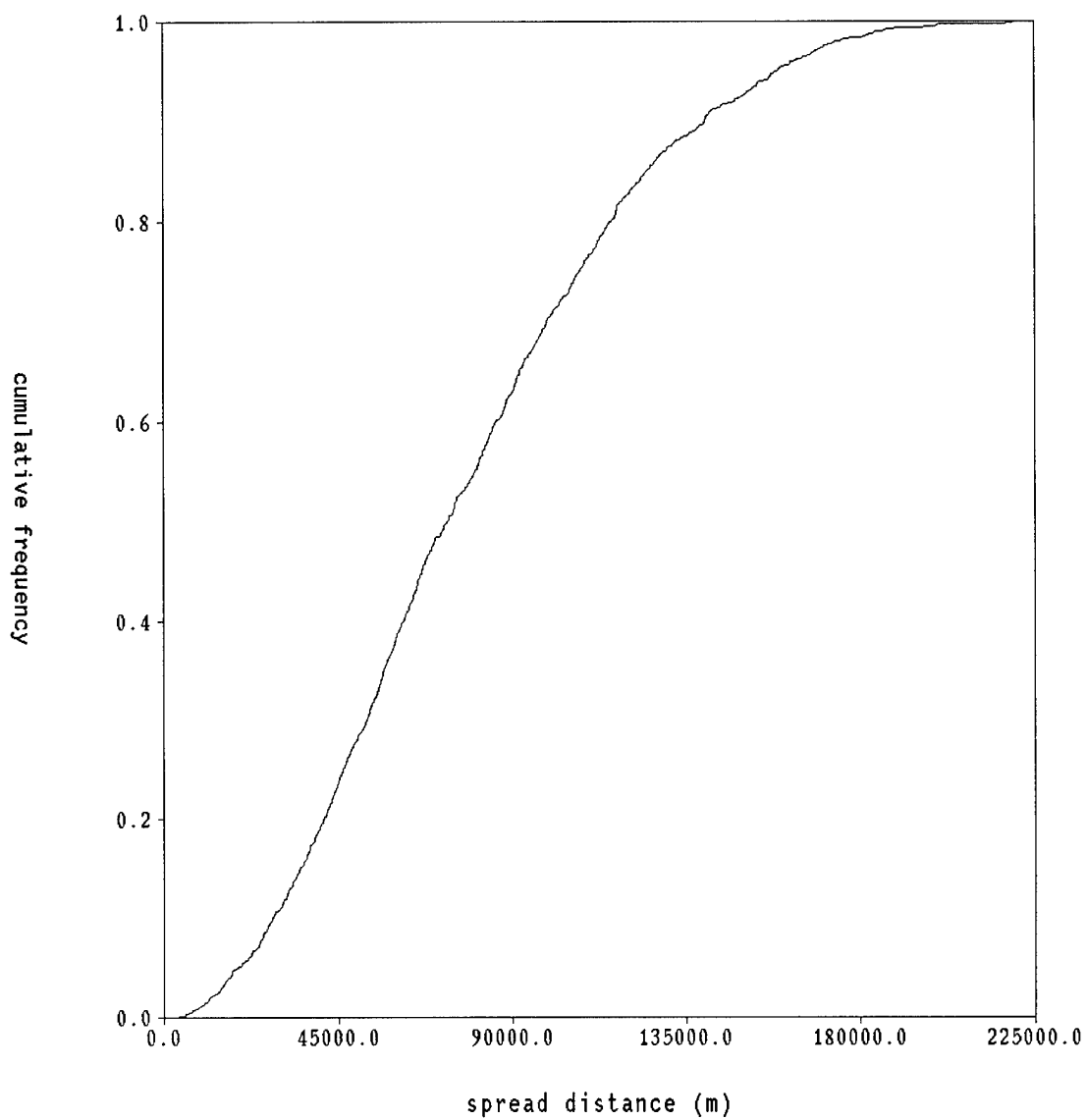
**Figure A-13. Spread Distance, Trapani, 5 km**



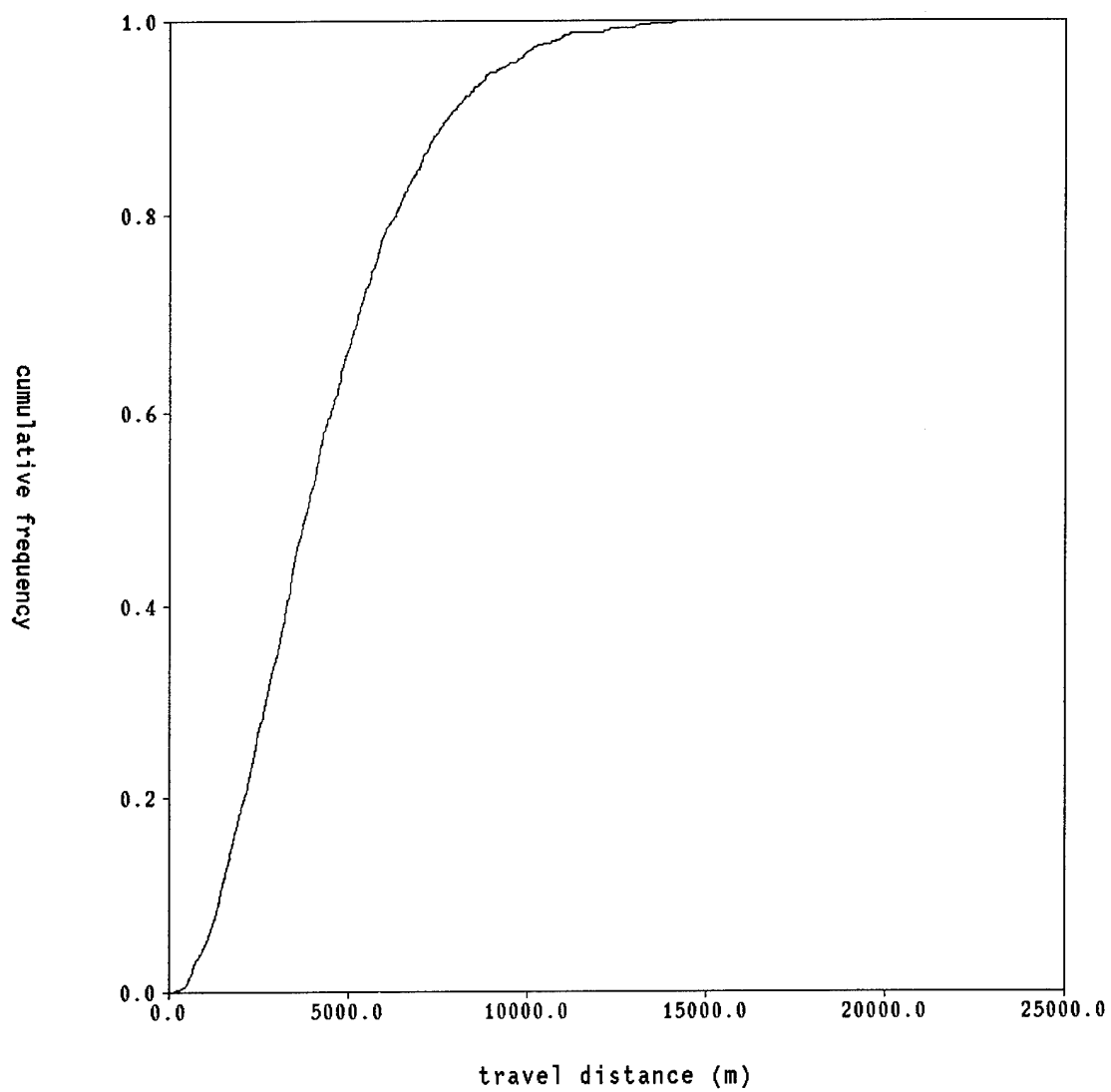
**Figure A-14. Spread Distance, Trapani, 10 km**



**Figure A-15. Spread Distance, Trapani, 20 km**

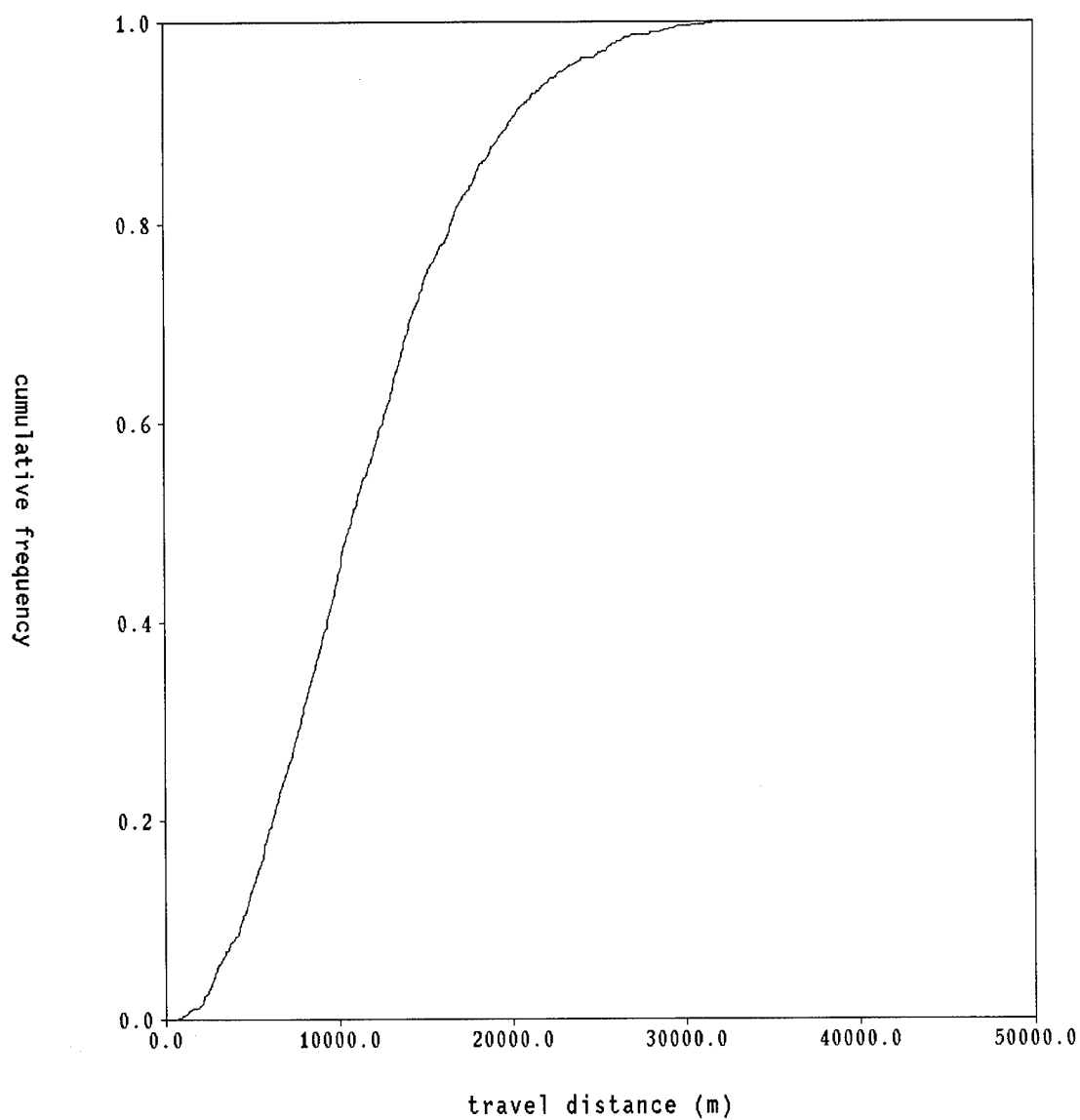


**Figure A-16. Spread Distance, Trapani, 30 km**

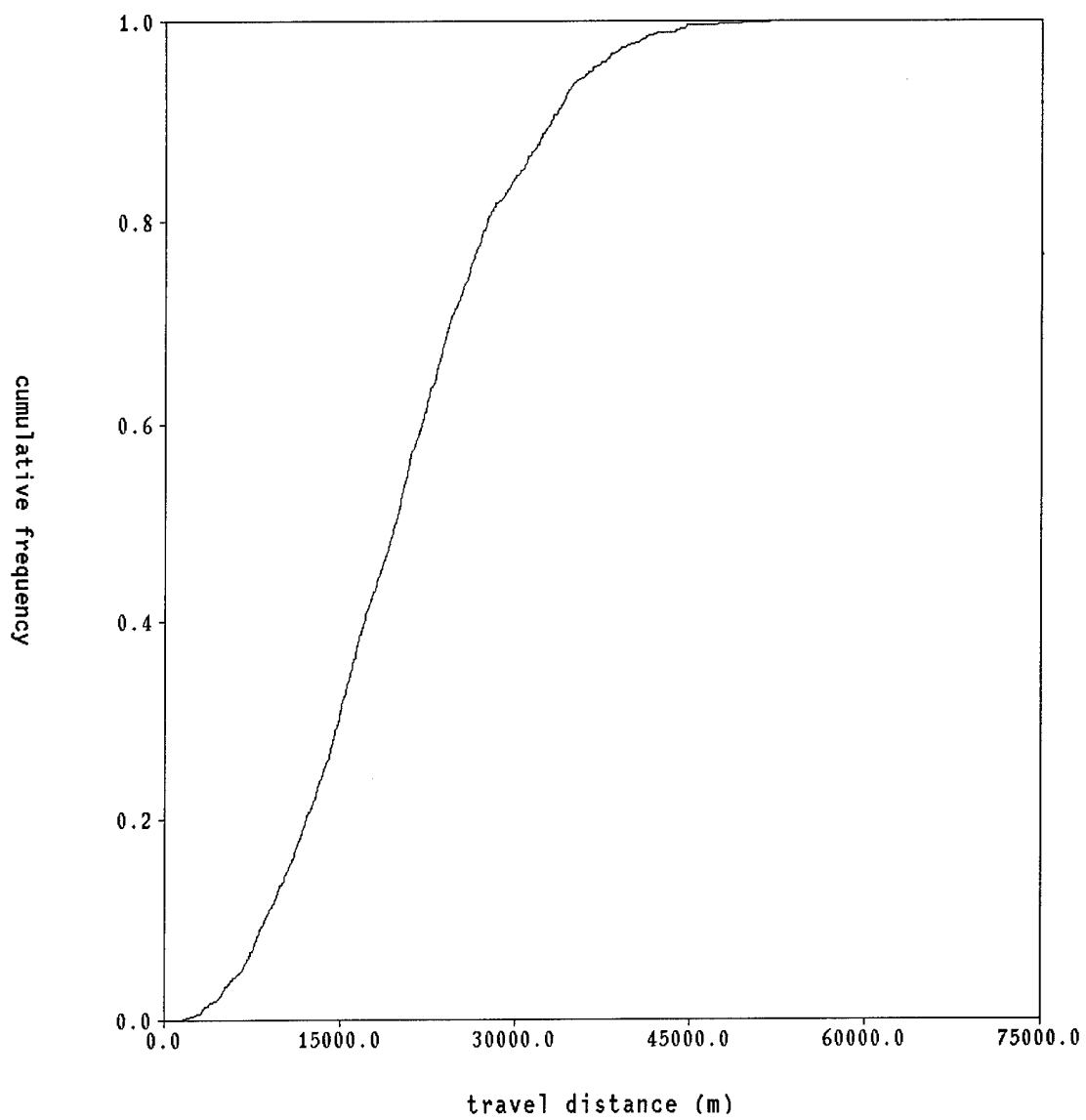


**Figure A-17. Travel Distance, Ankara, 5 km**

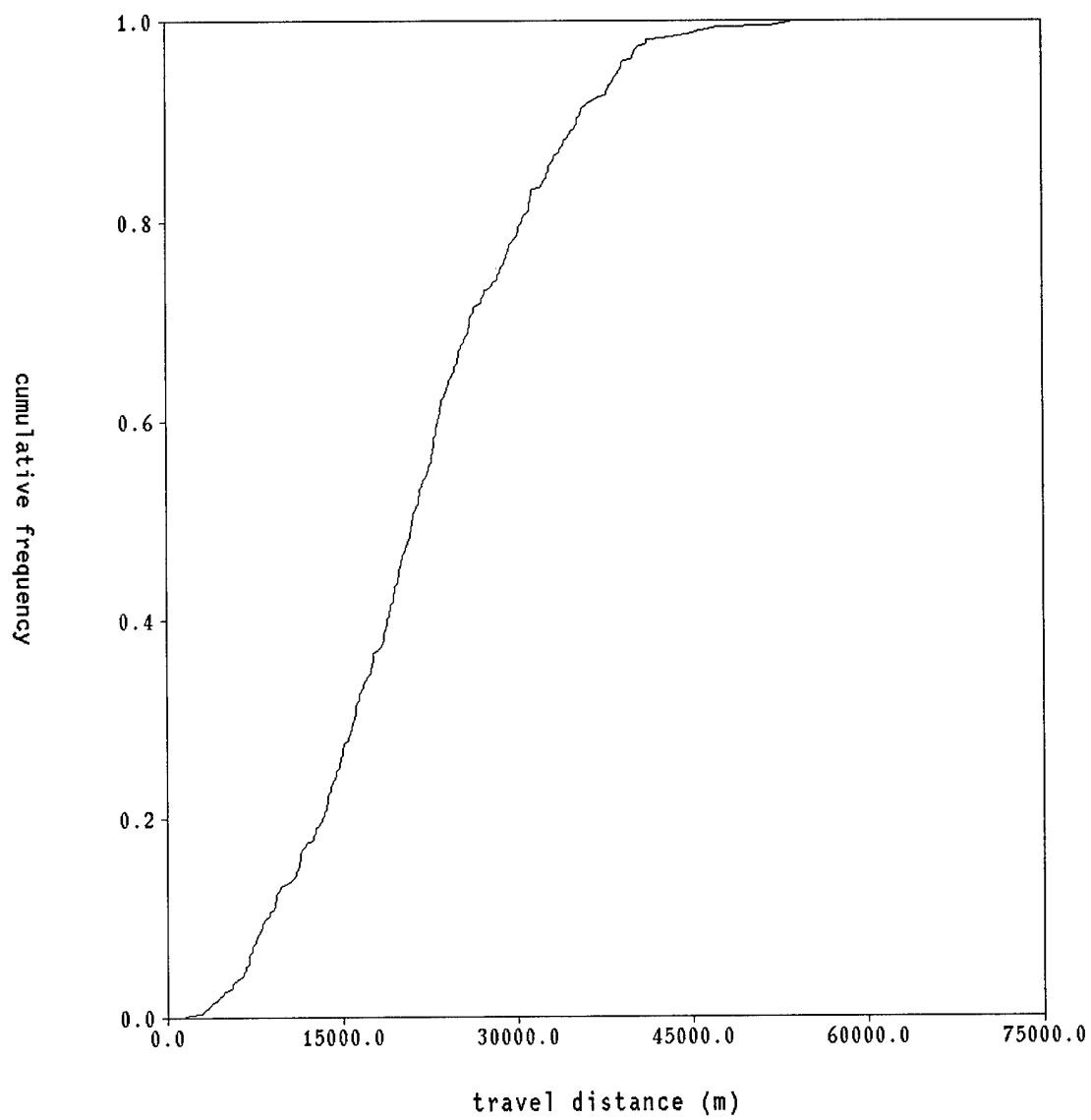




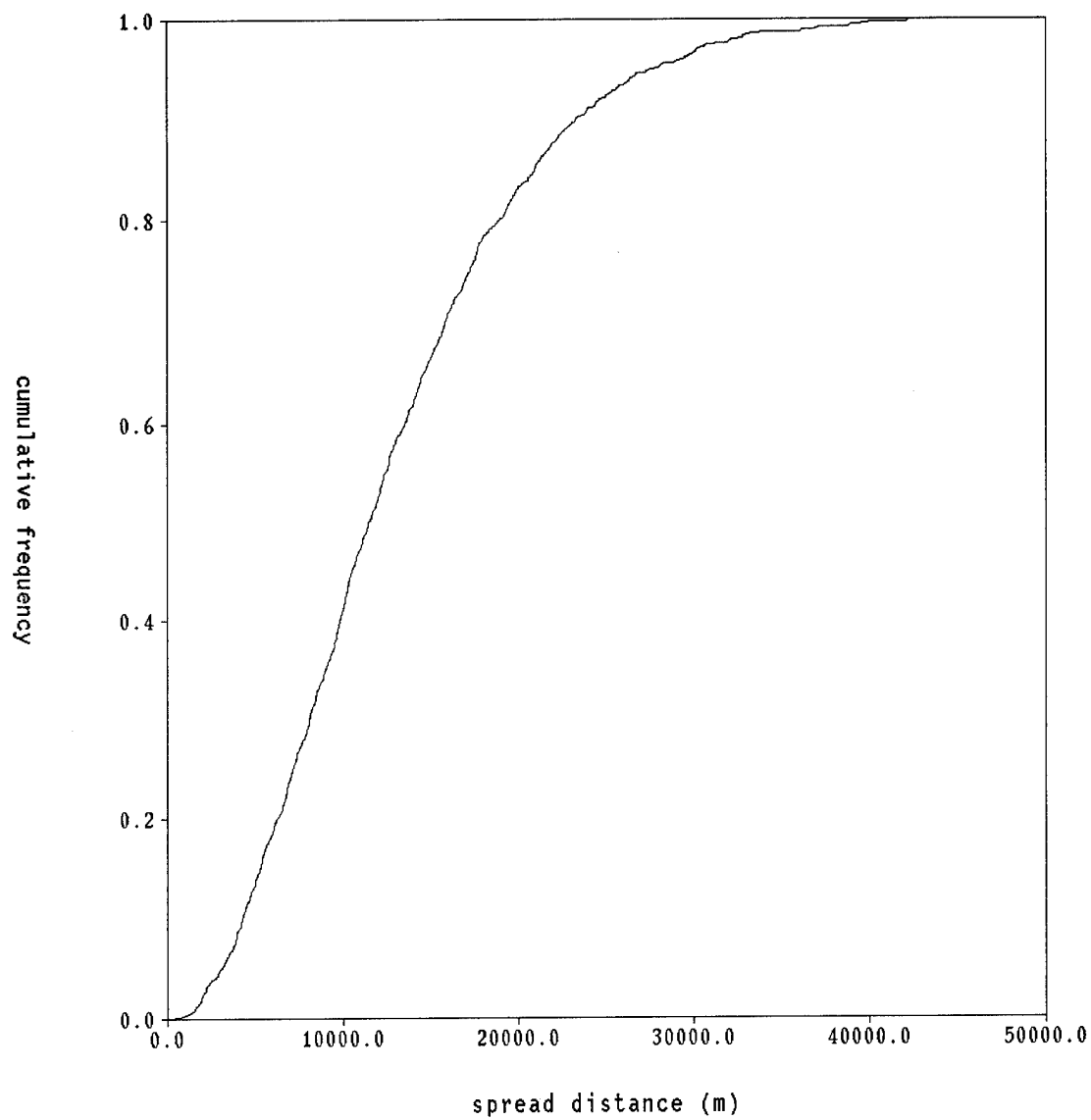
**Figure A-18. Travel Distance, Ankara, 10 km**



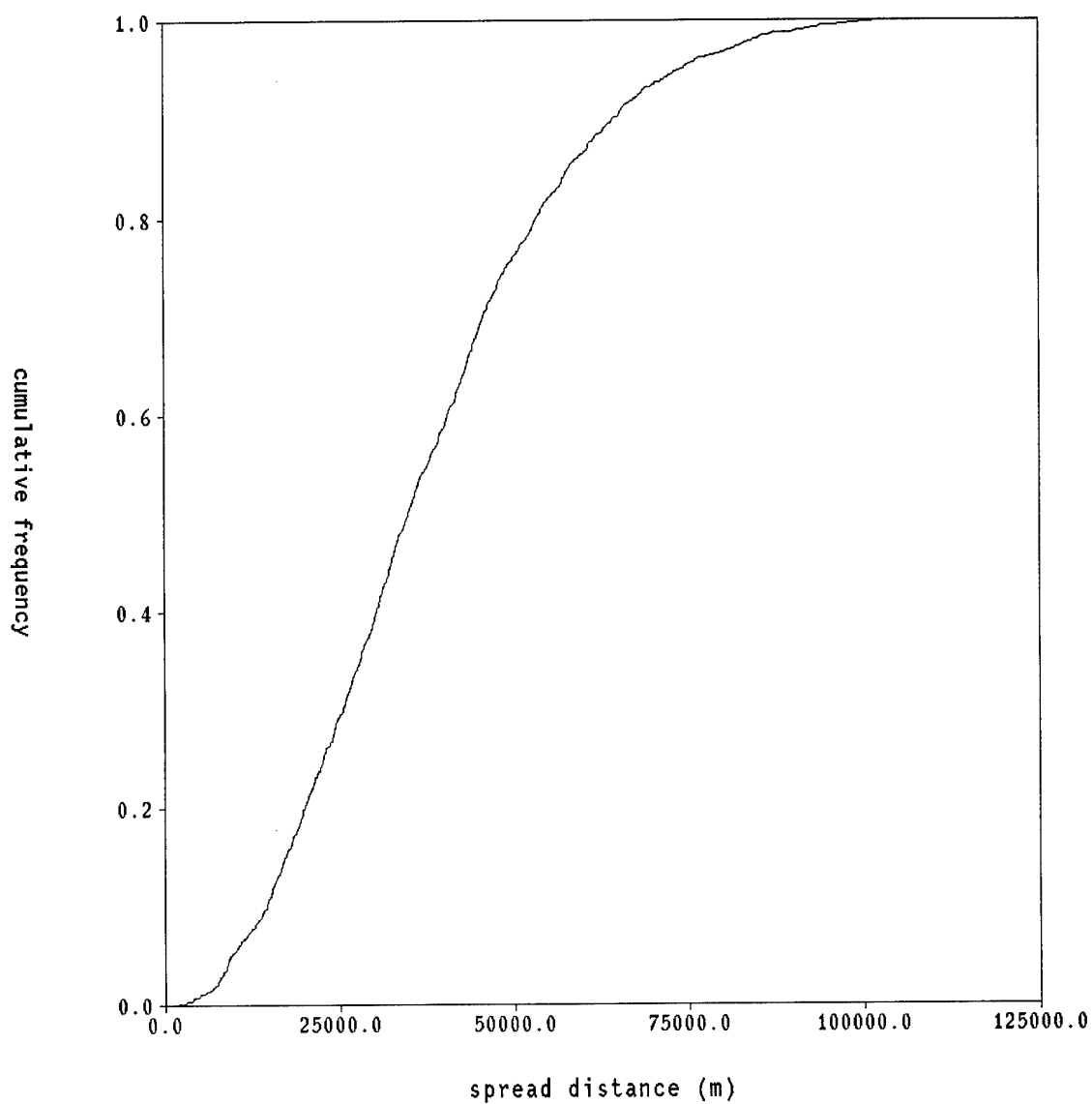
**Figure A-19. Travel Distance, Ankara, 20 km**



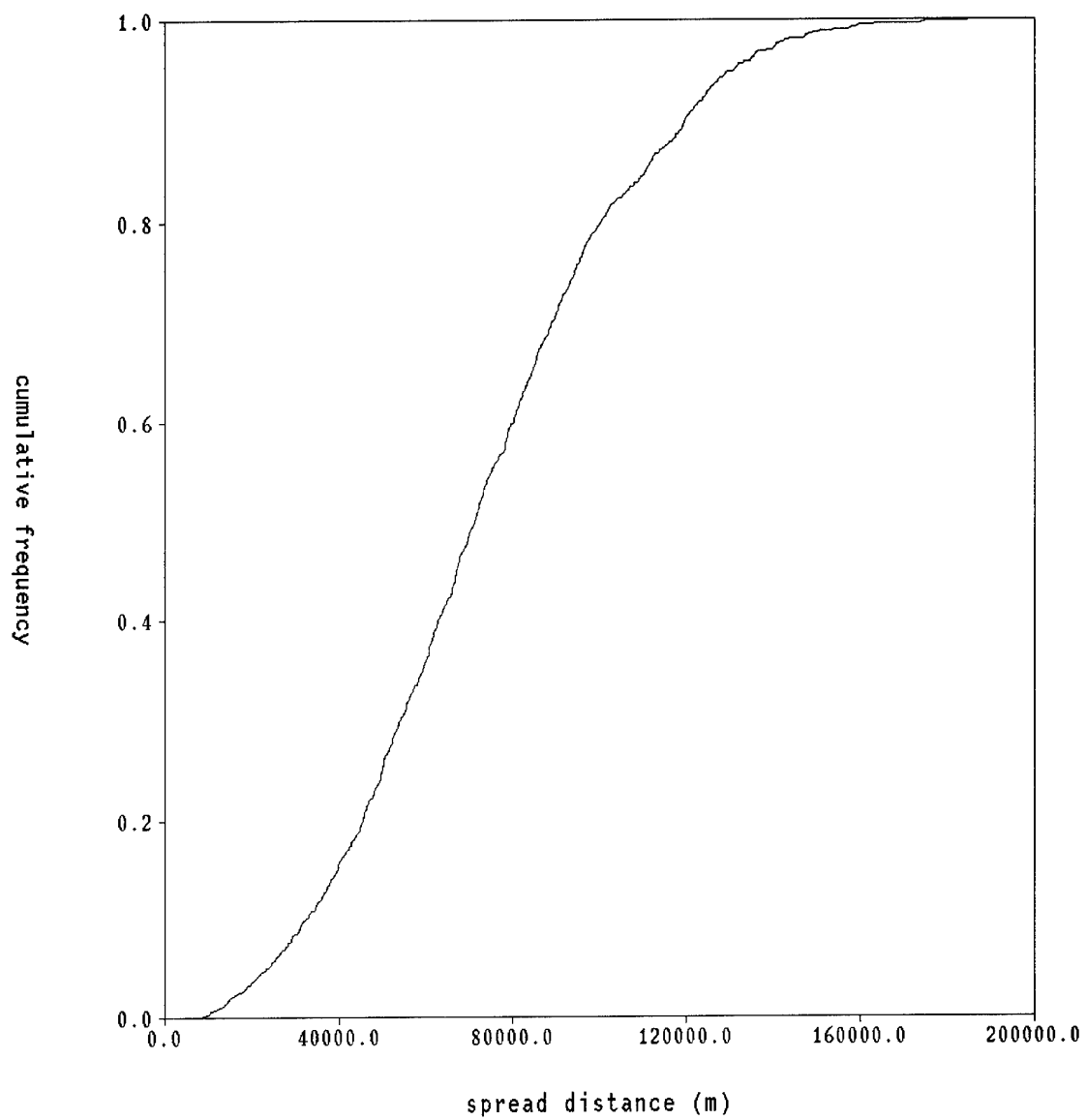
**Figure A-20. Travel Distance, Ankara, 30 km**



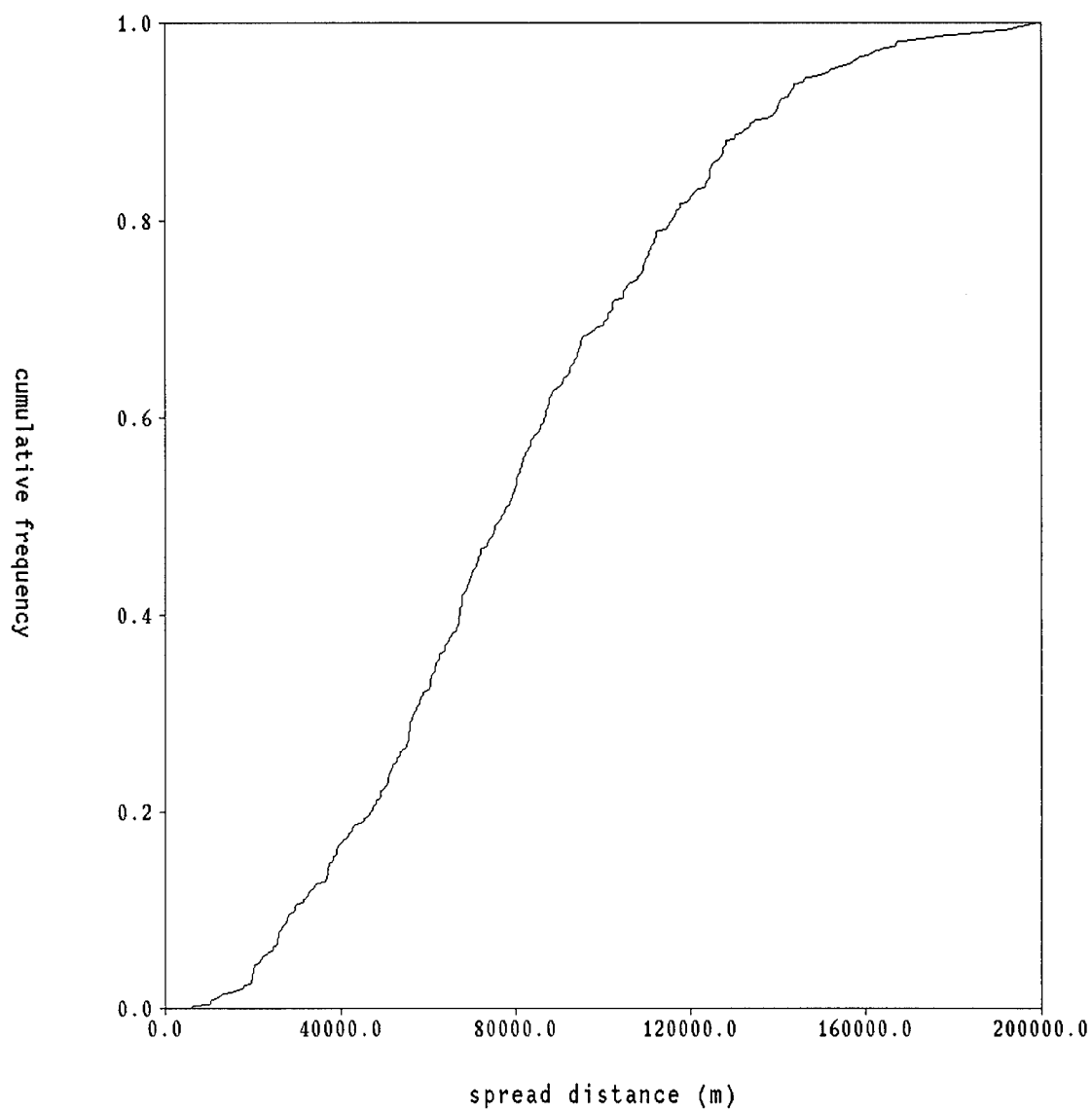
**Figure A-21. Spread Distance, Ankara, 5 km**



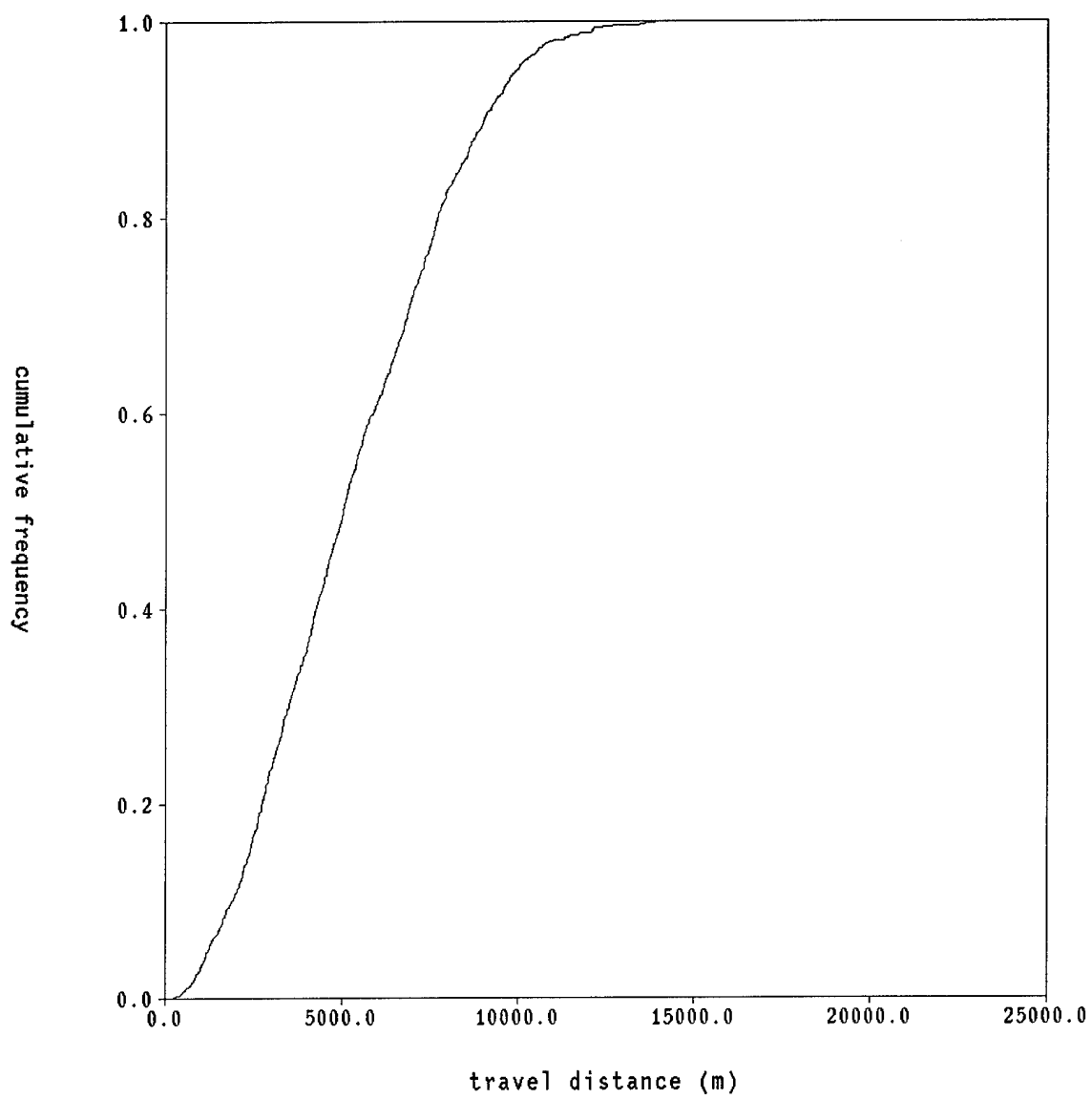
**Figure A-22. Spread Distance, Ankara, 10 km**



**Figure A-23. Spread Distance, Ankara, 20 km**

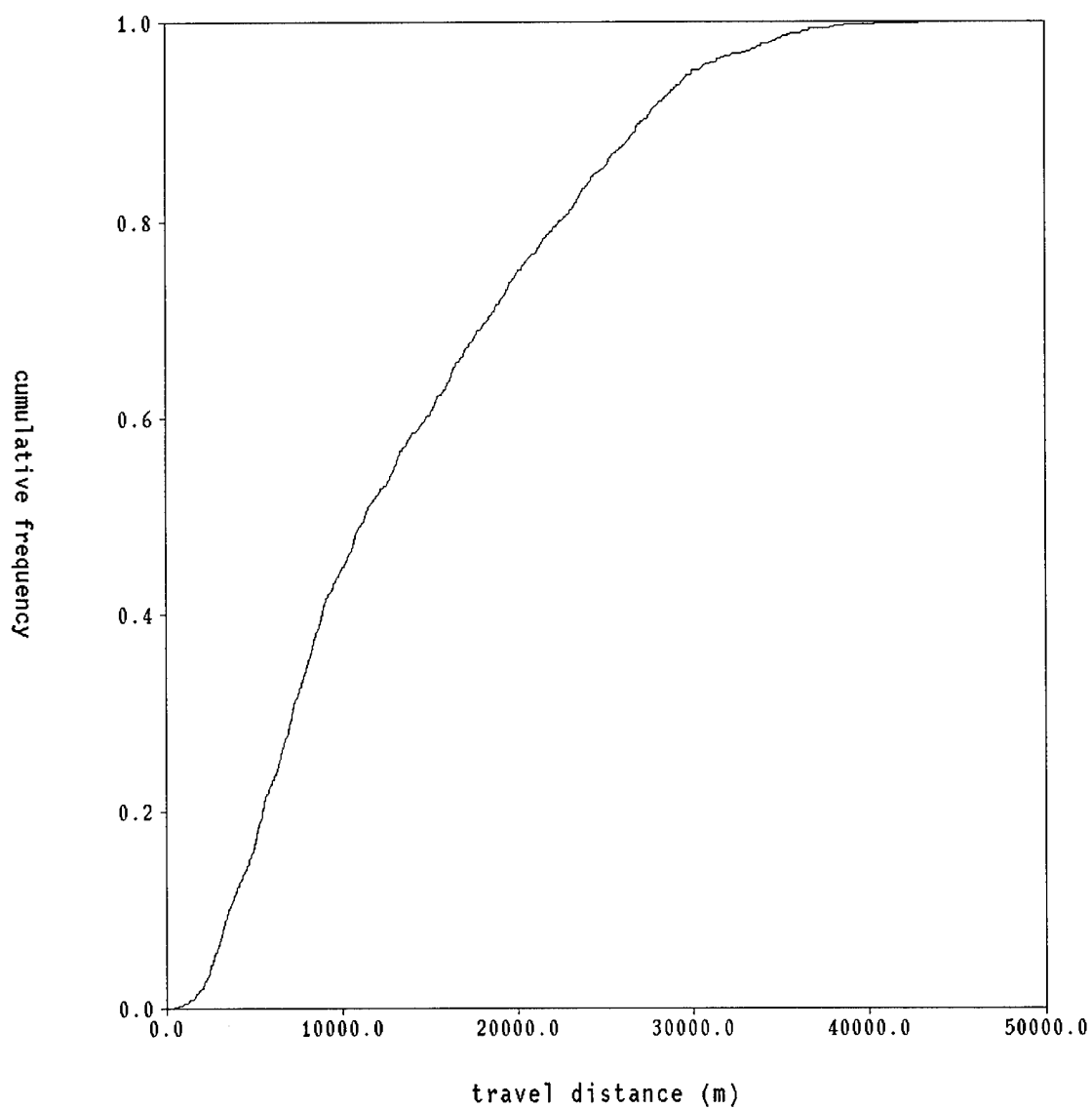


**Figure A-24. Spread Distance, Ankara, 30 km**

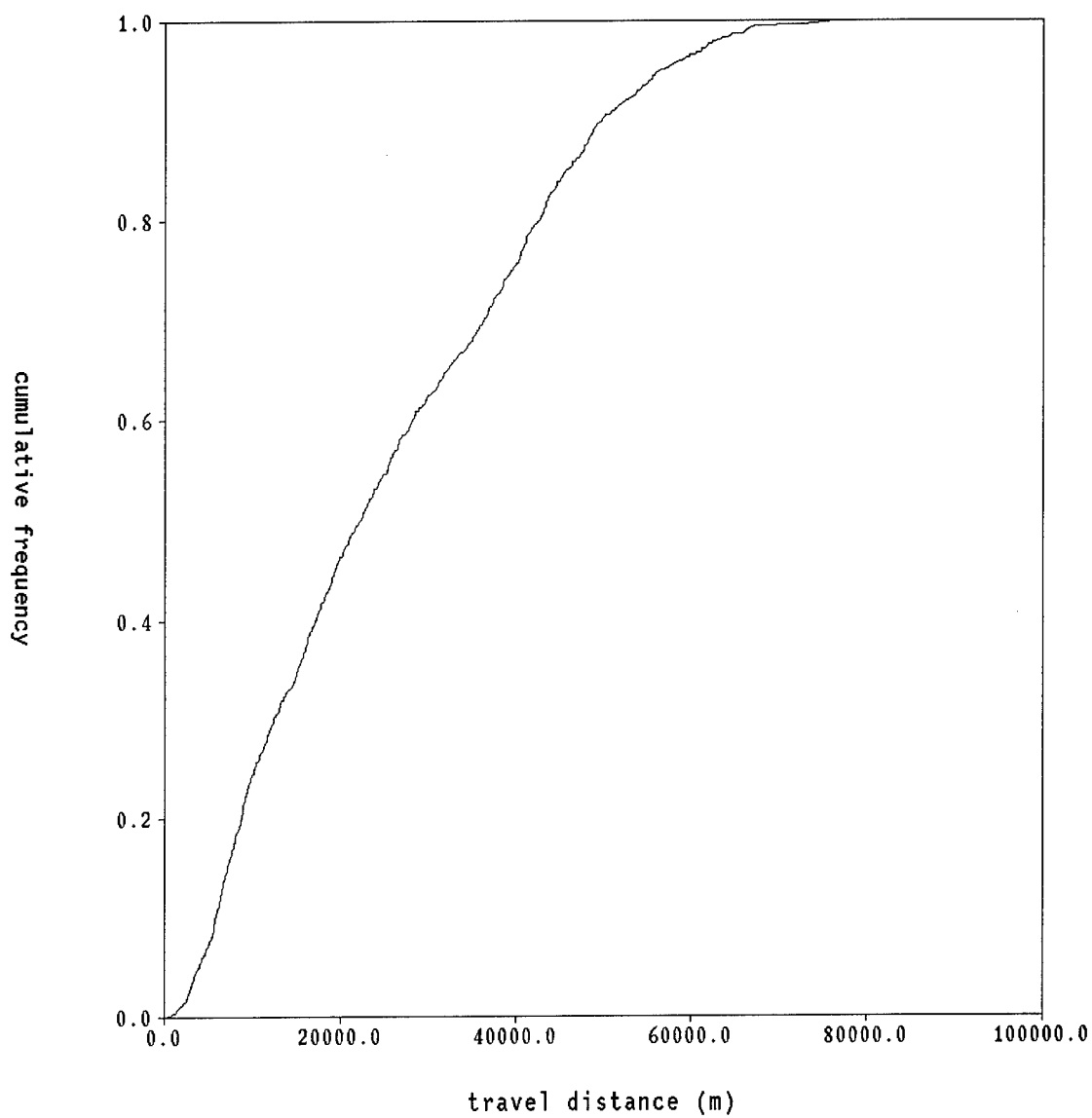


**Figure A-25. Travel Distance, Dhahran, 5 km**

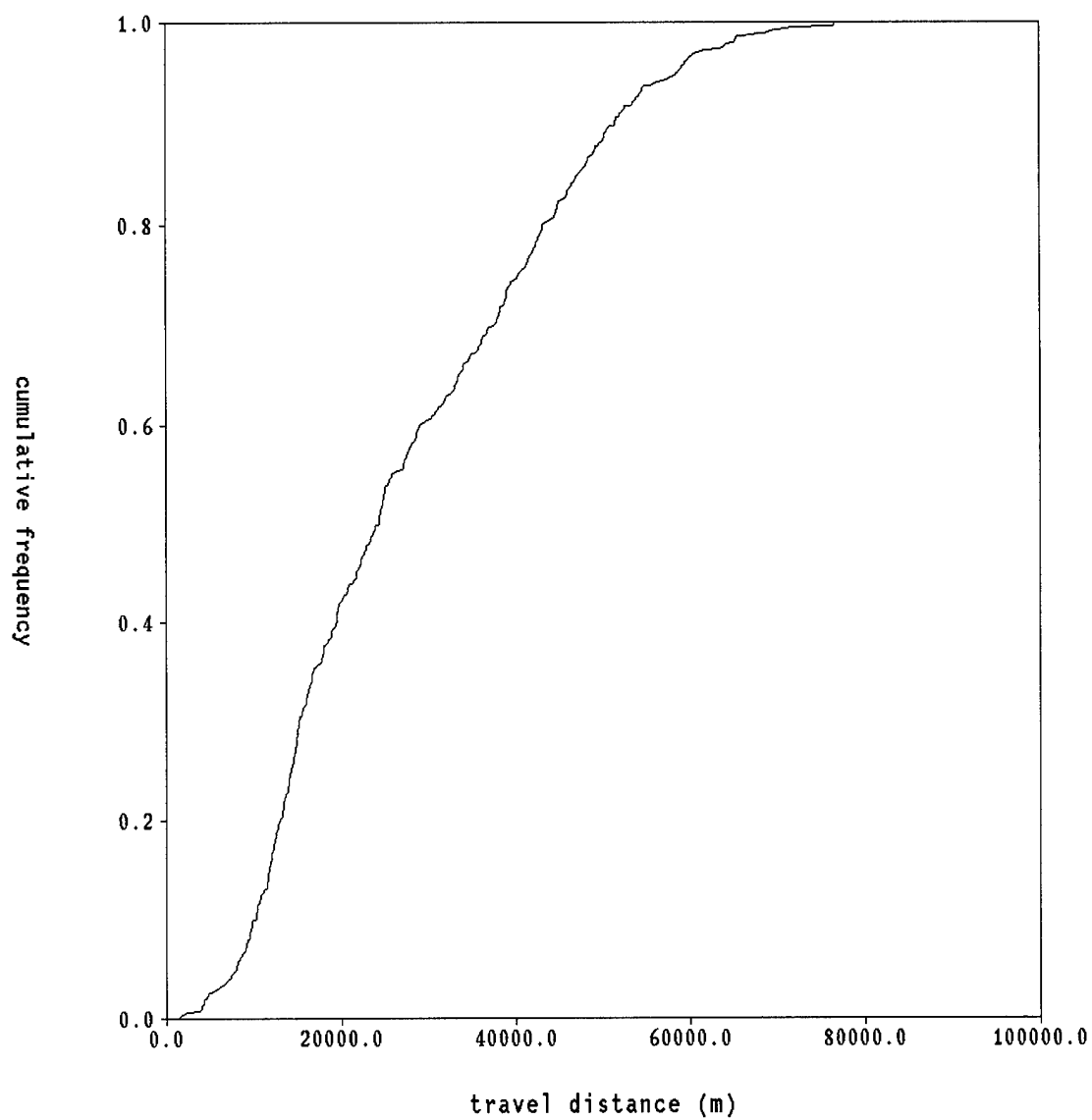




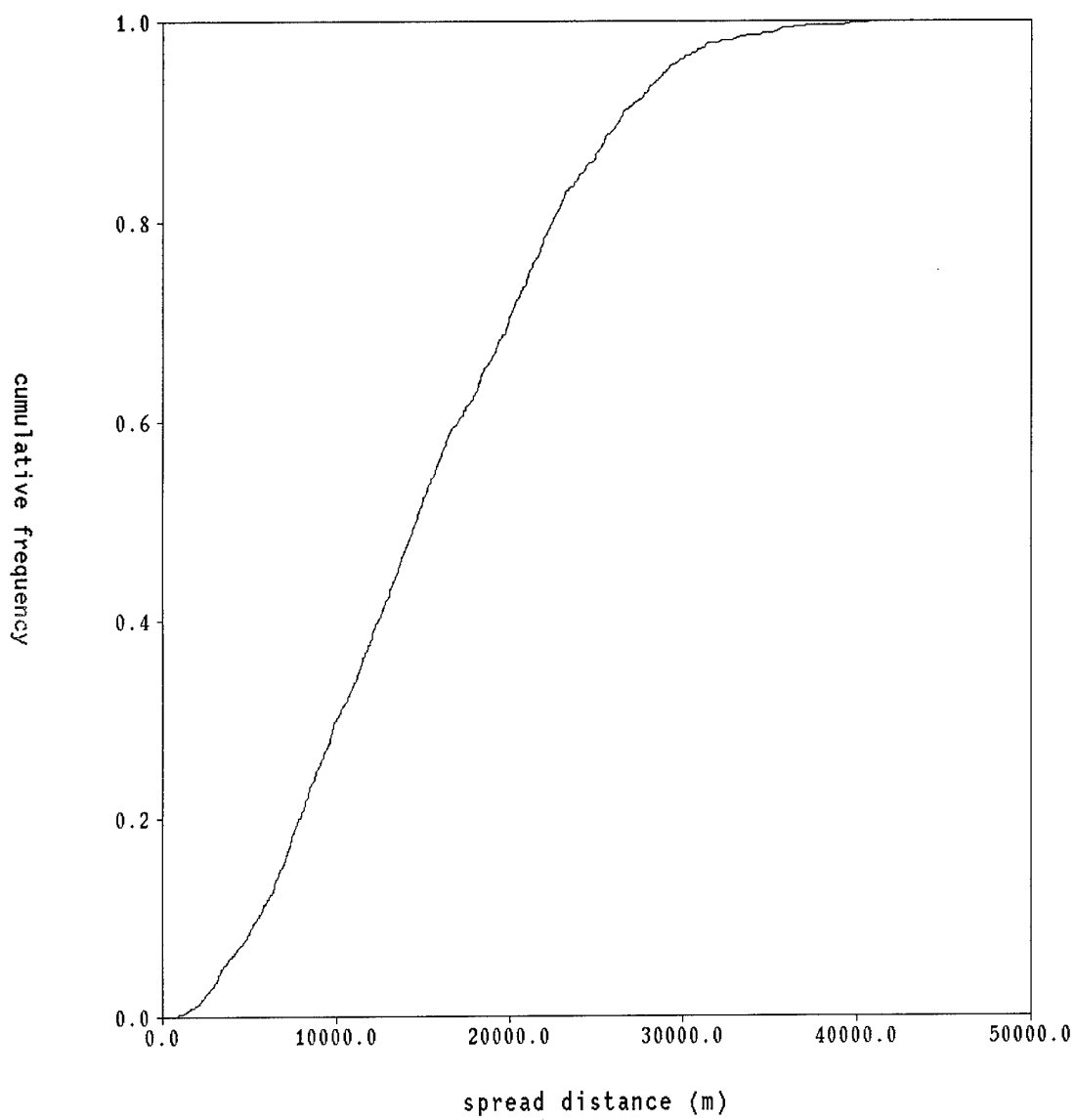
**Figure A-26. Travel Distance, Dhahran, 10 km**



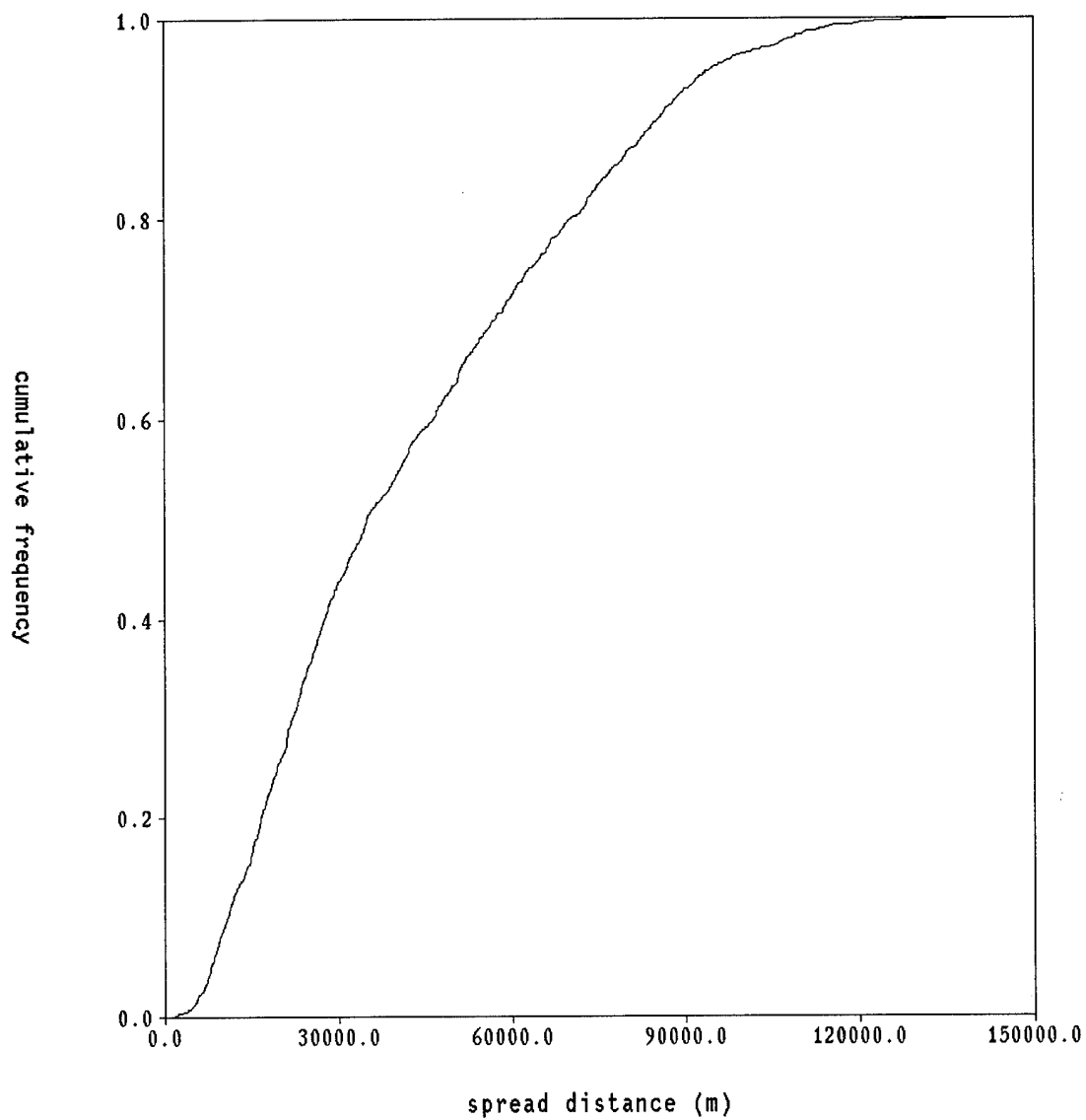
**Figure A-27. Travel Distance, Dhahran, 20 km**



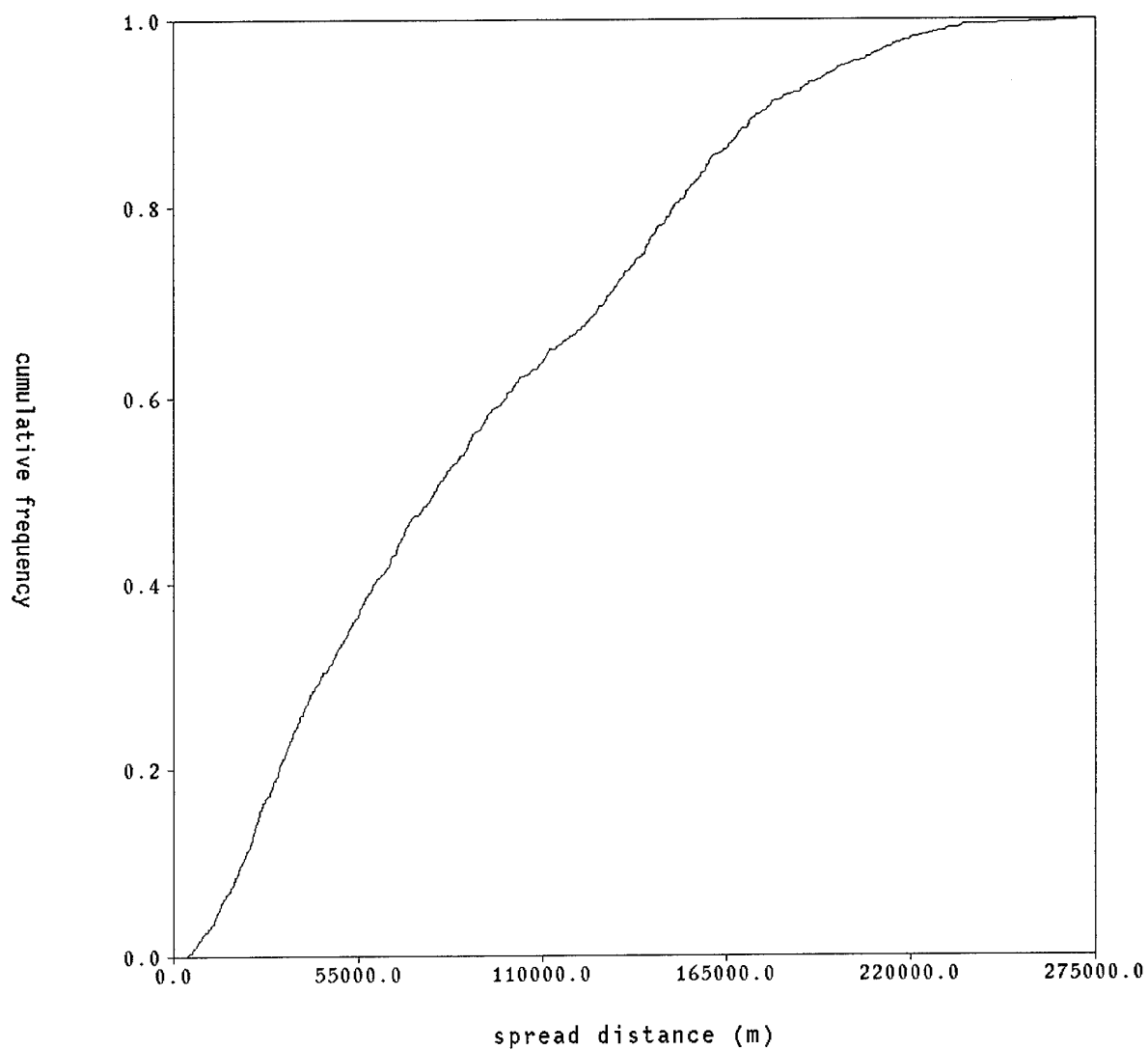
**Figure A-28. Travel Distance, Dhahran, 30 km**



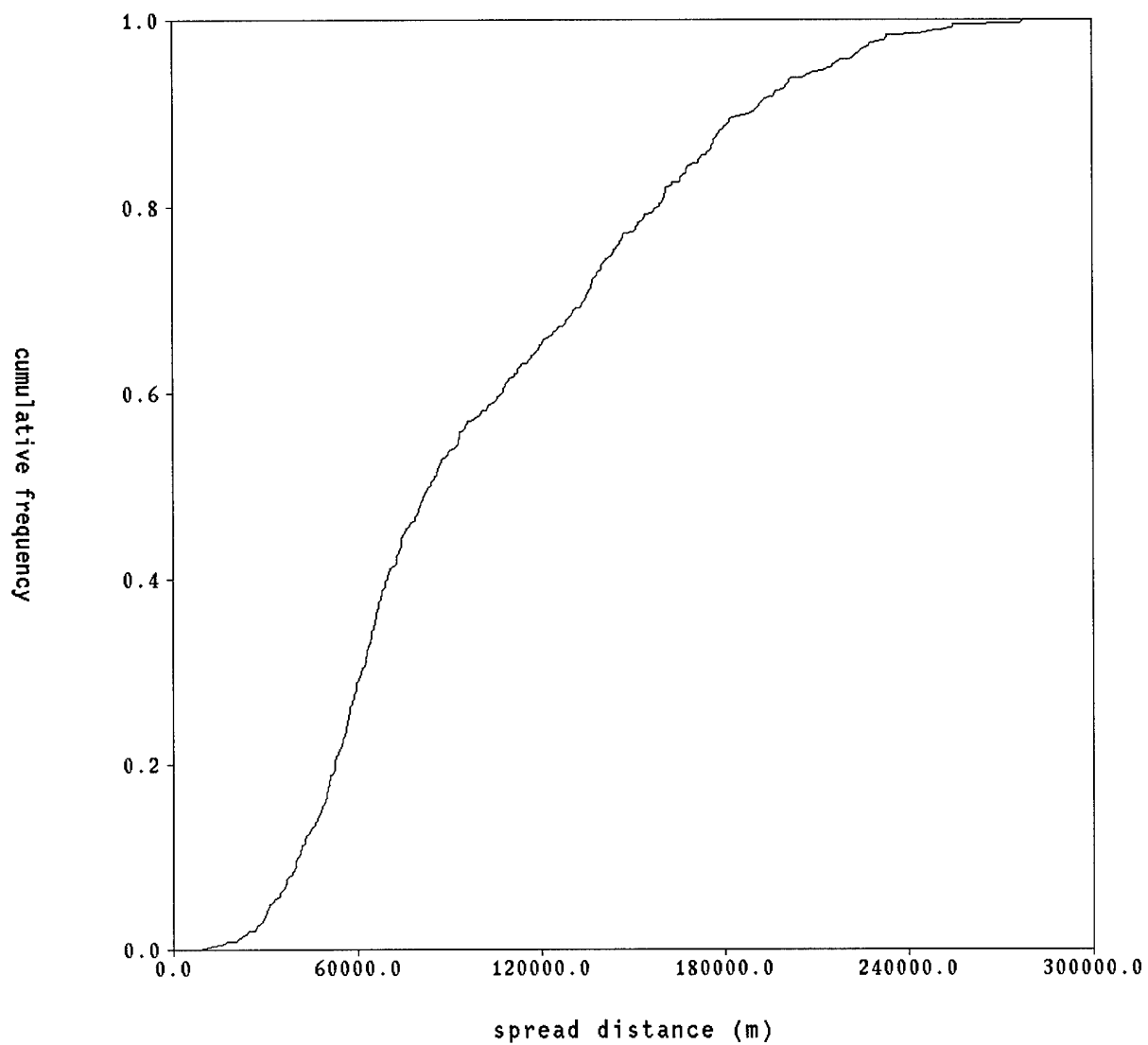
**Figure A-29. Spread Distance, Dhahran, 5 km**



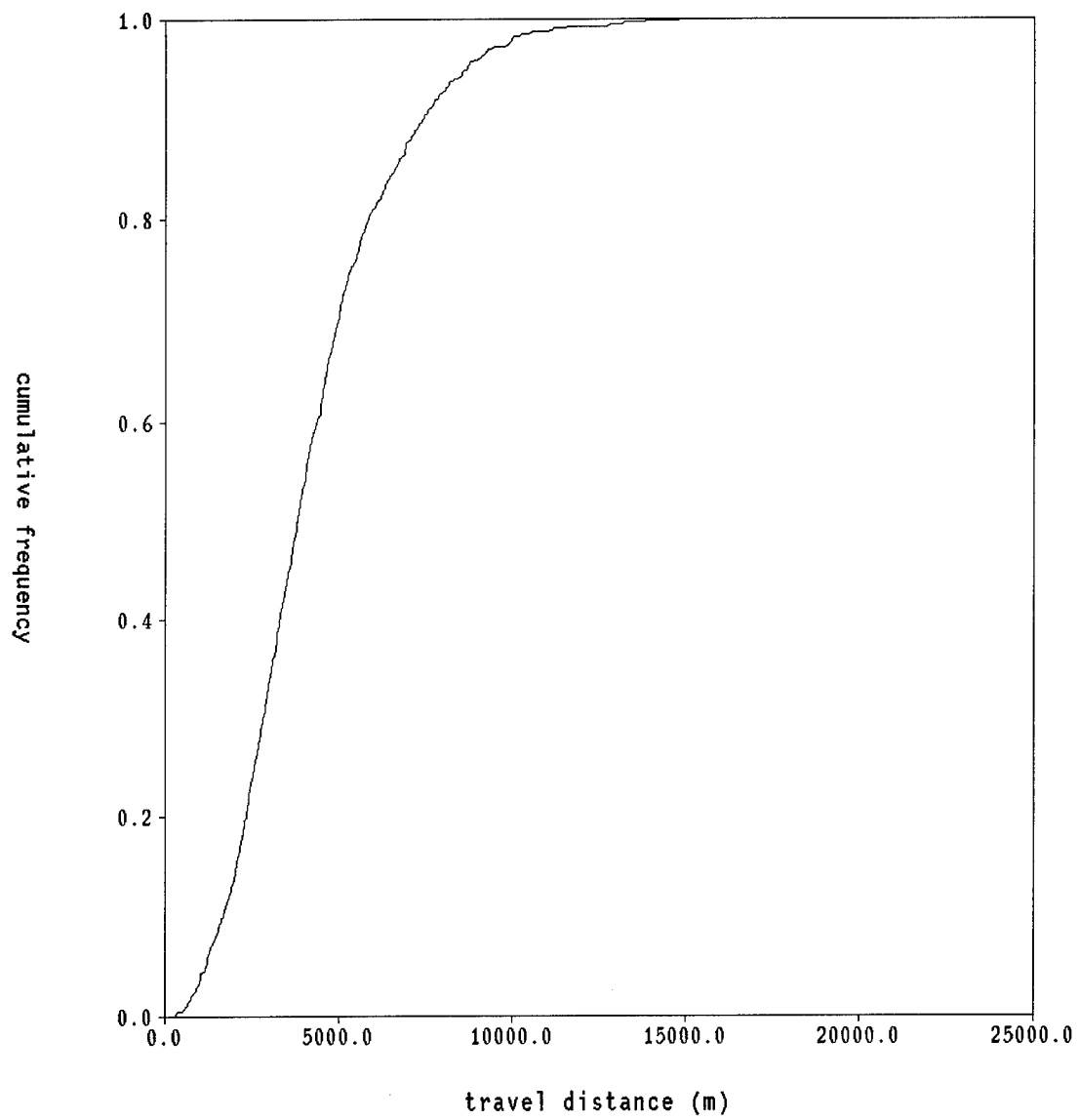
**Figure A-30. Spread Distance, Dhahran, 10 km**



**Figure A-31. Spread Distance, Dhahran, 20 km**

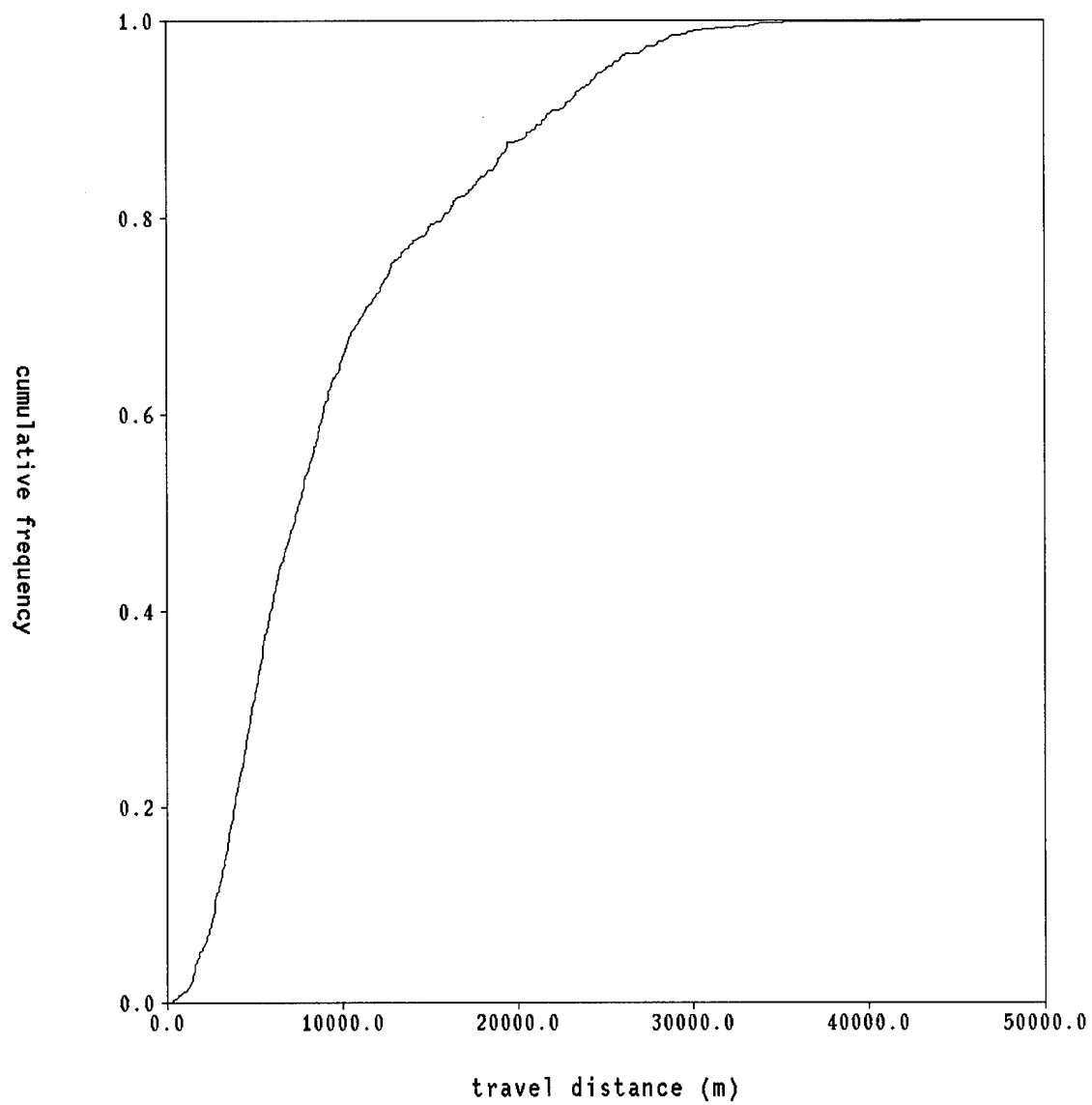


**Figure A-32. Spread Distance, Dhahran, 30 km**

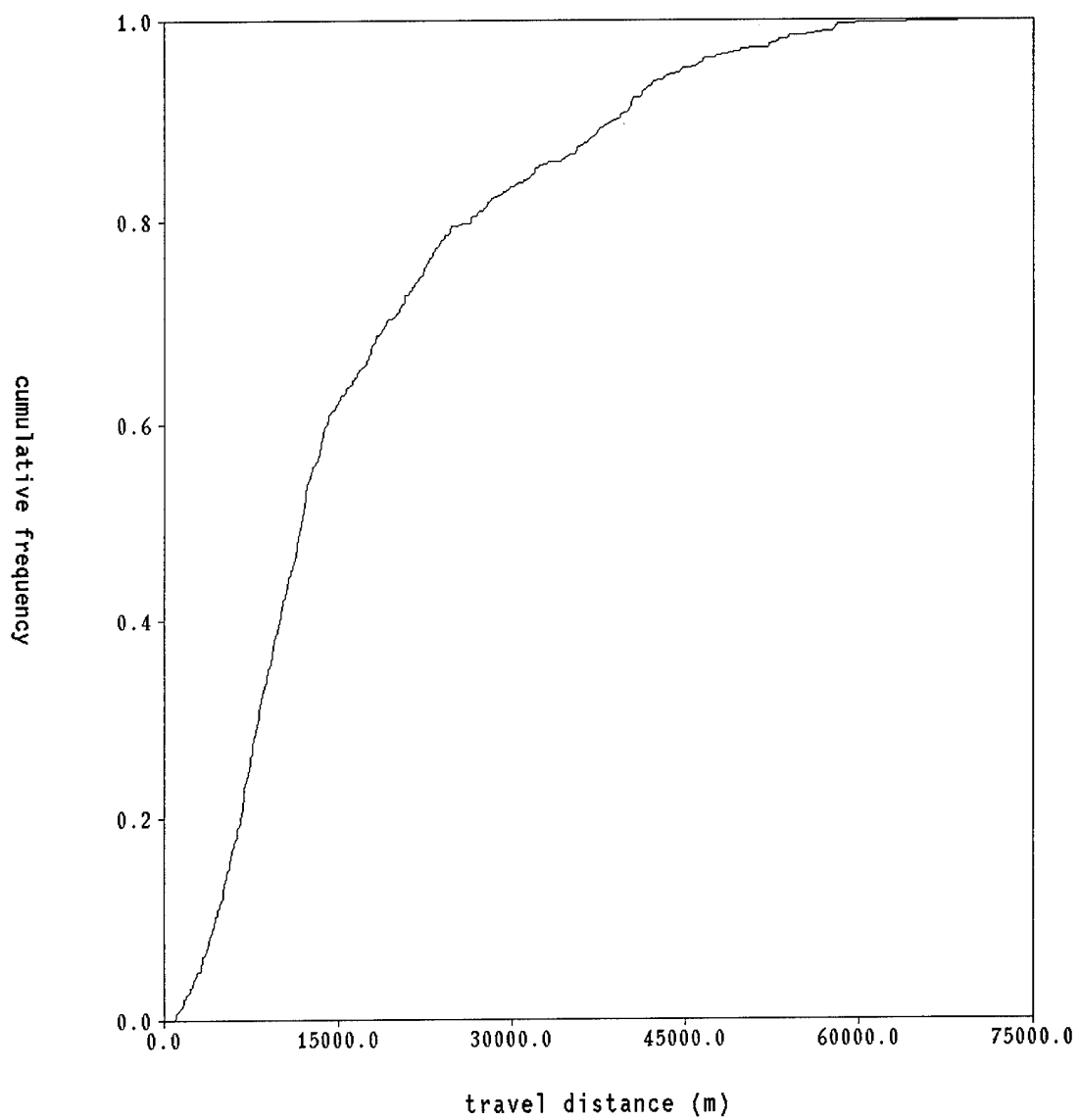


**Figure A-33. Travel Distance, Riyadh, 5 km**

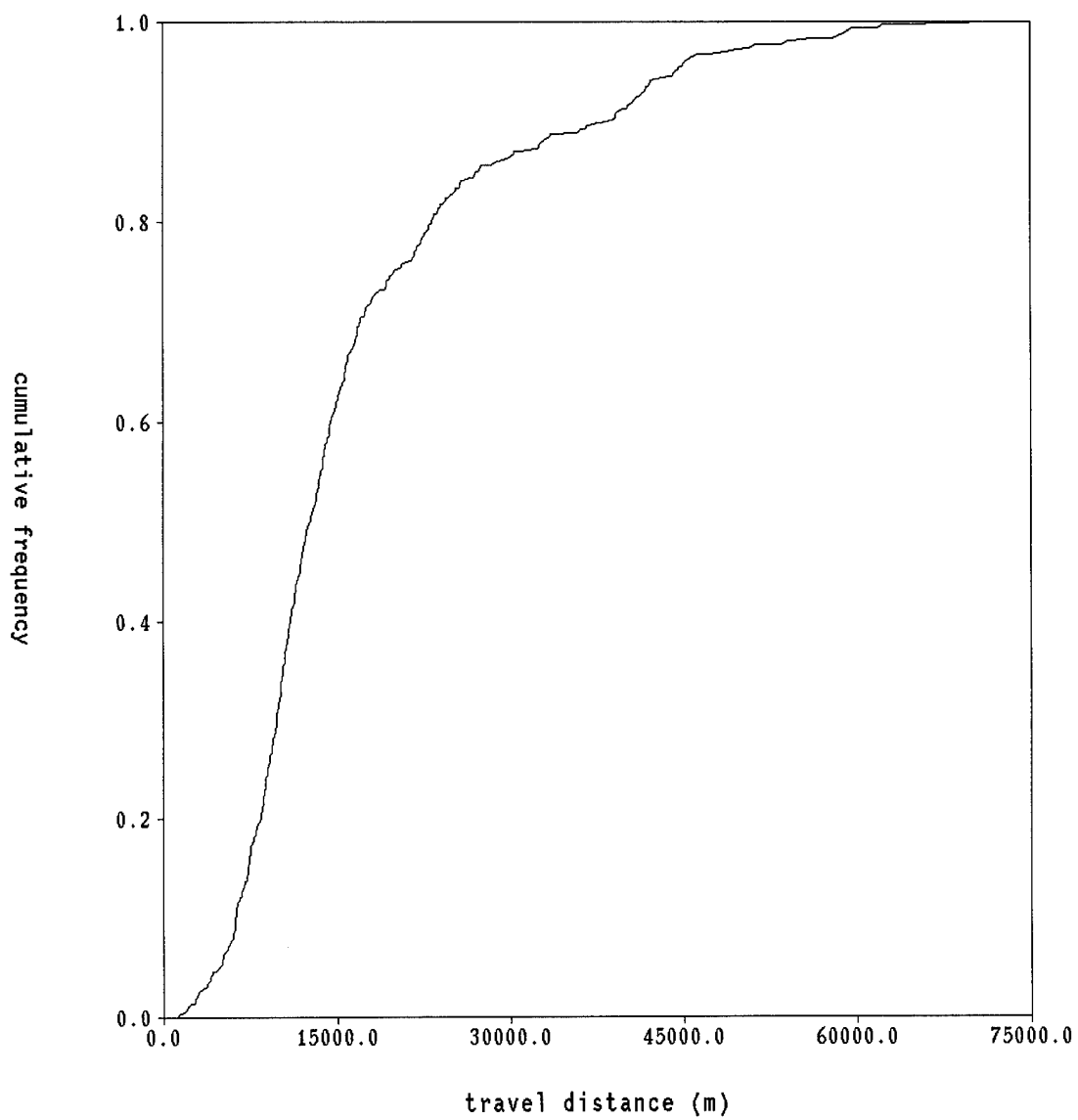




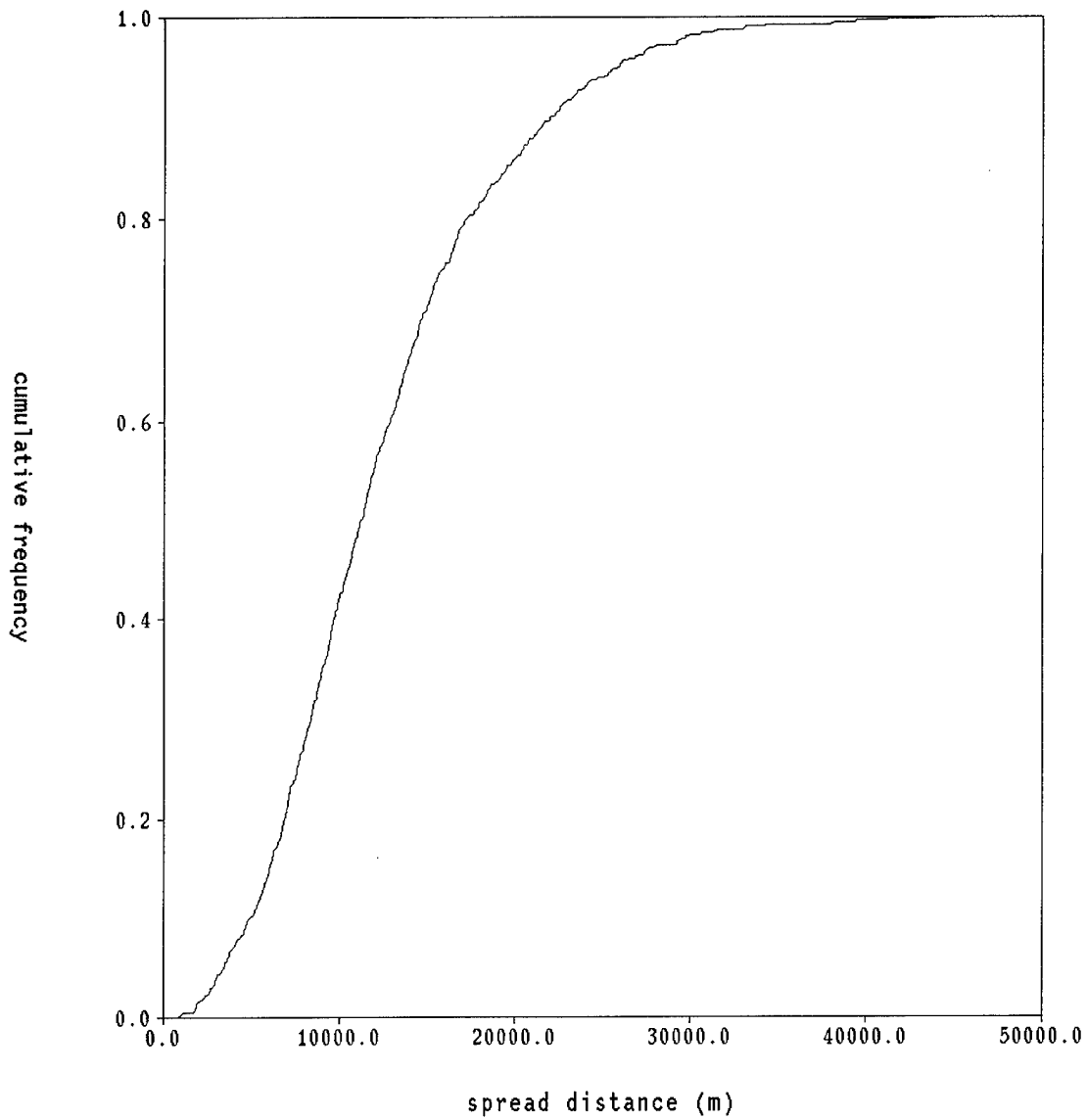
**Figure A-34. Travel Distance, Riyadh, 10 km**



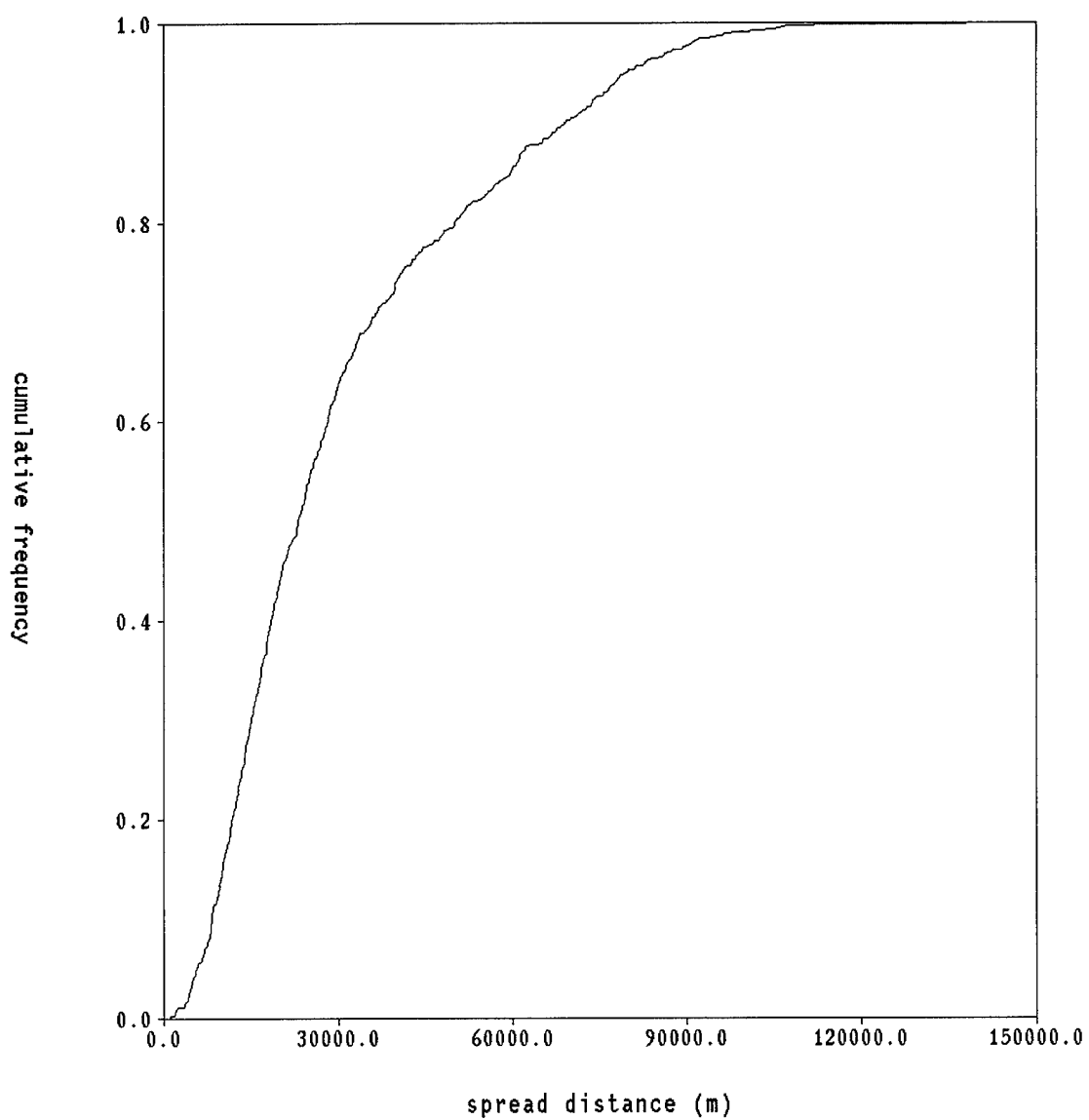
**Figure A-35. Travel Distance, Riyadh, 20 km**



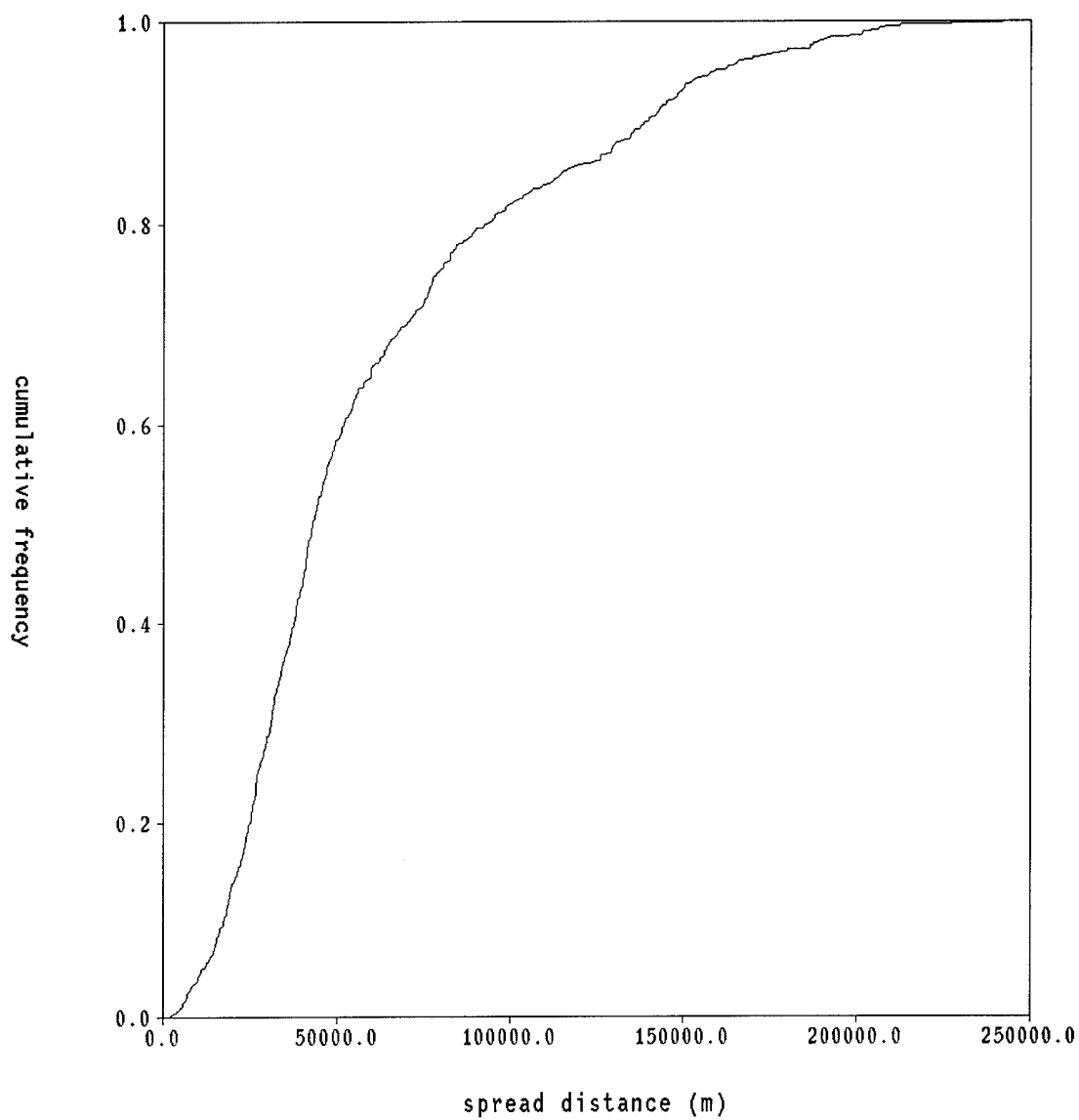
**Figure A-36. Travel Distance, Riyadh, 30 km**



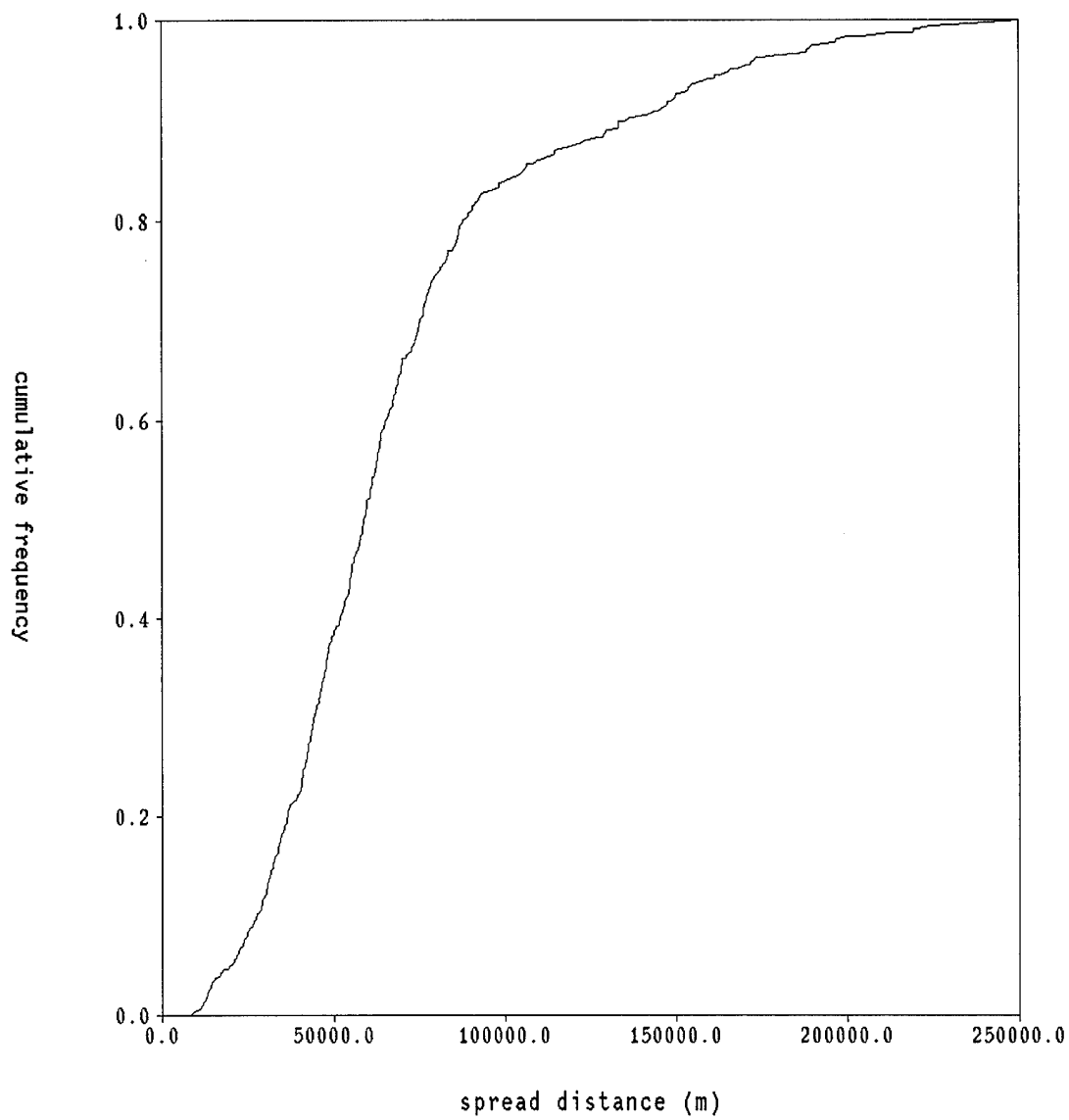
**Figure A-37. Spread Distance, Riyadh, 5 km**



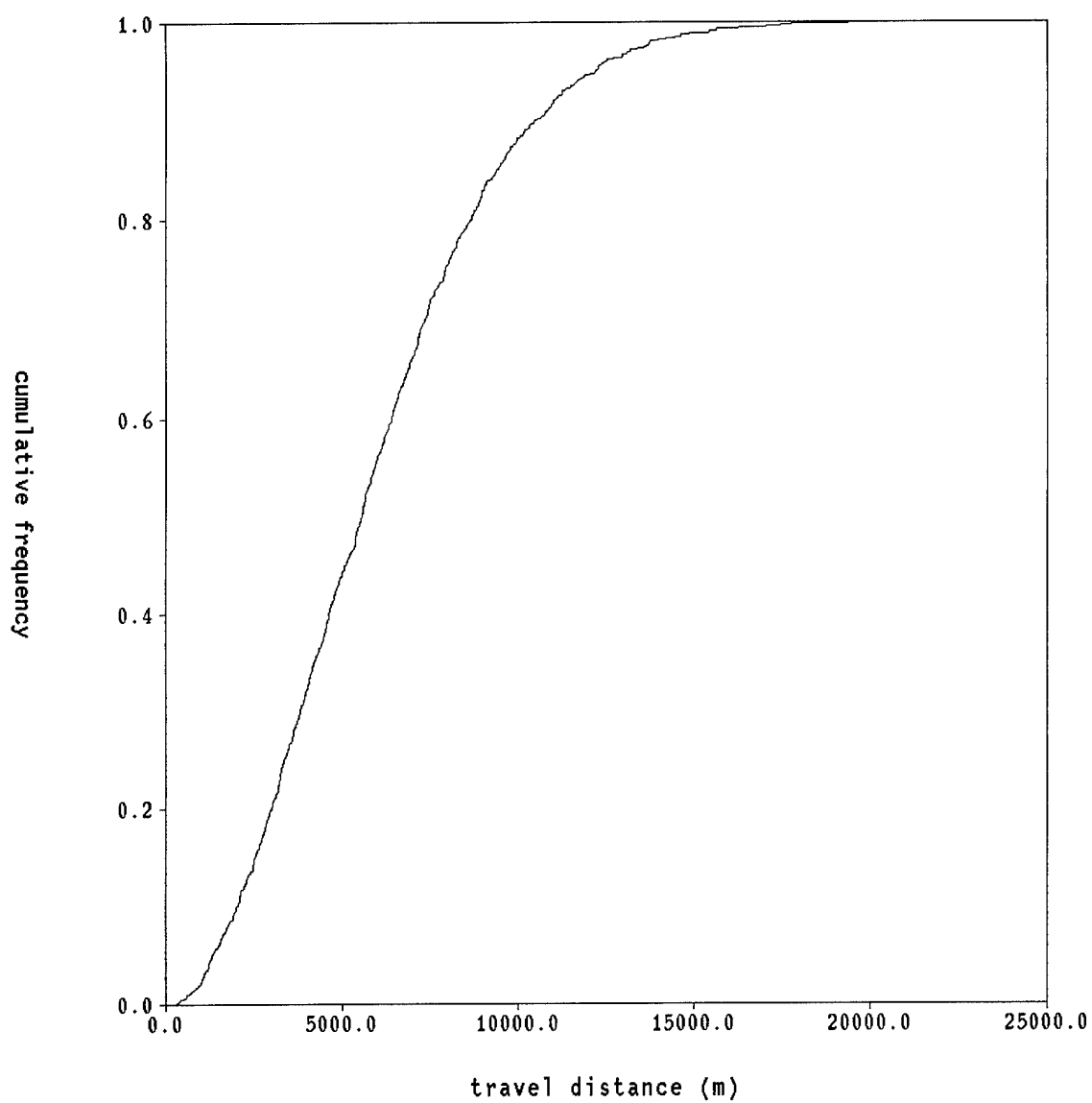
**Figure A-38. Spread Distance, Riyadh, 10 km**



**Figure A-39. Spread Distance, Riyadh, 20 km**

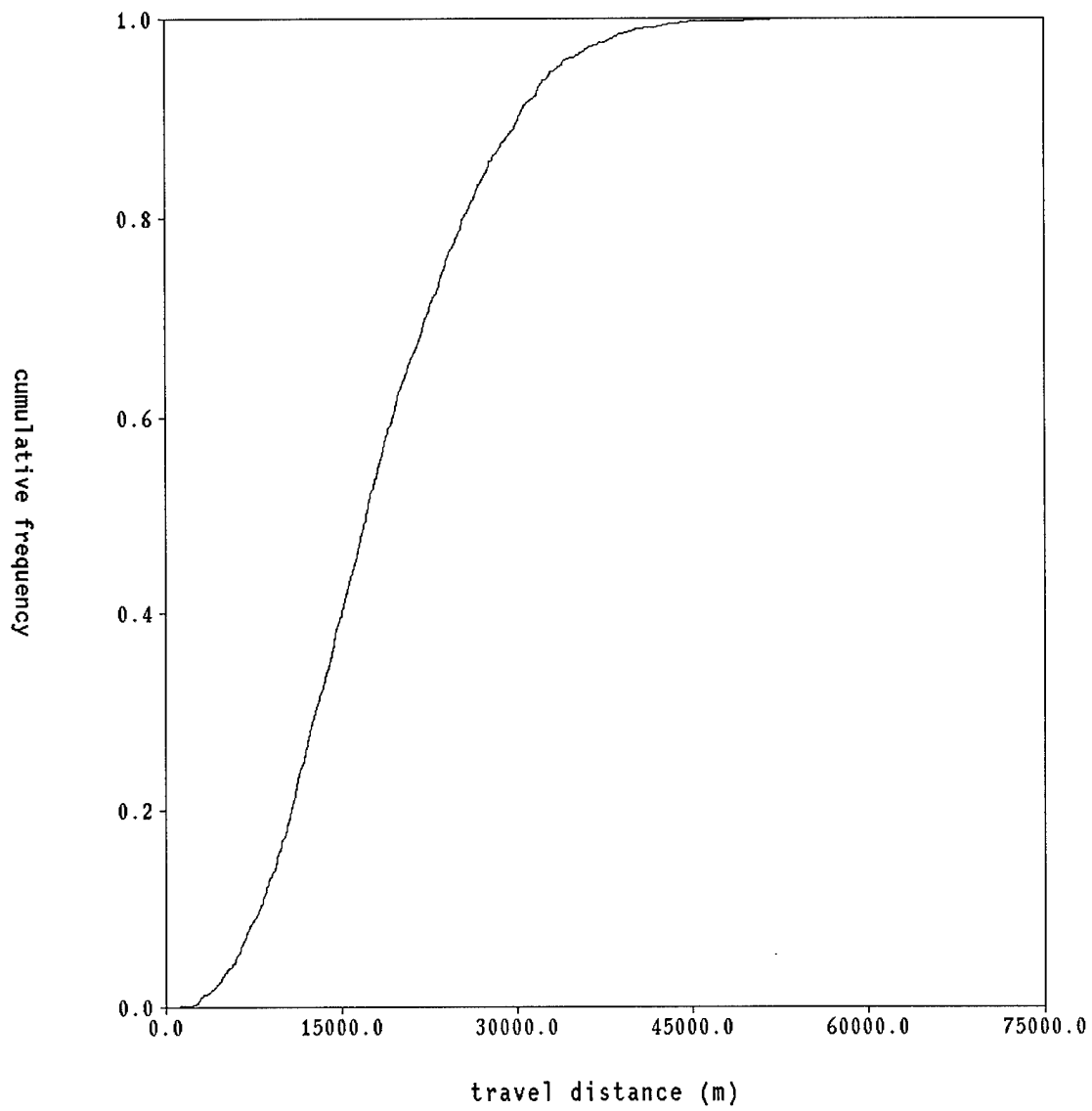


**Figure A-40. Spread Distance, Riyadh, 30 km**

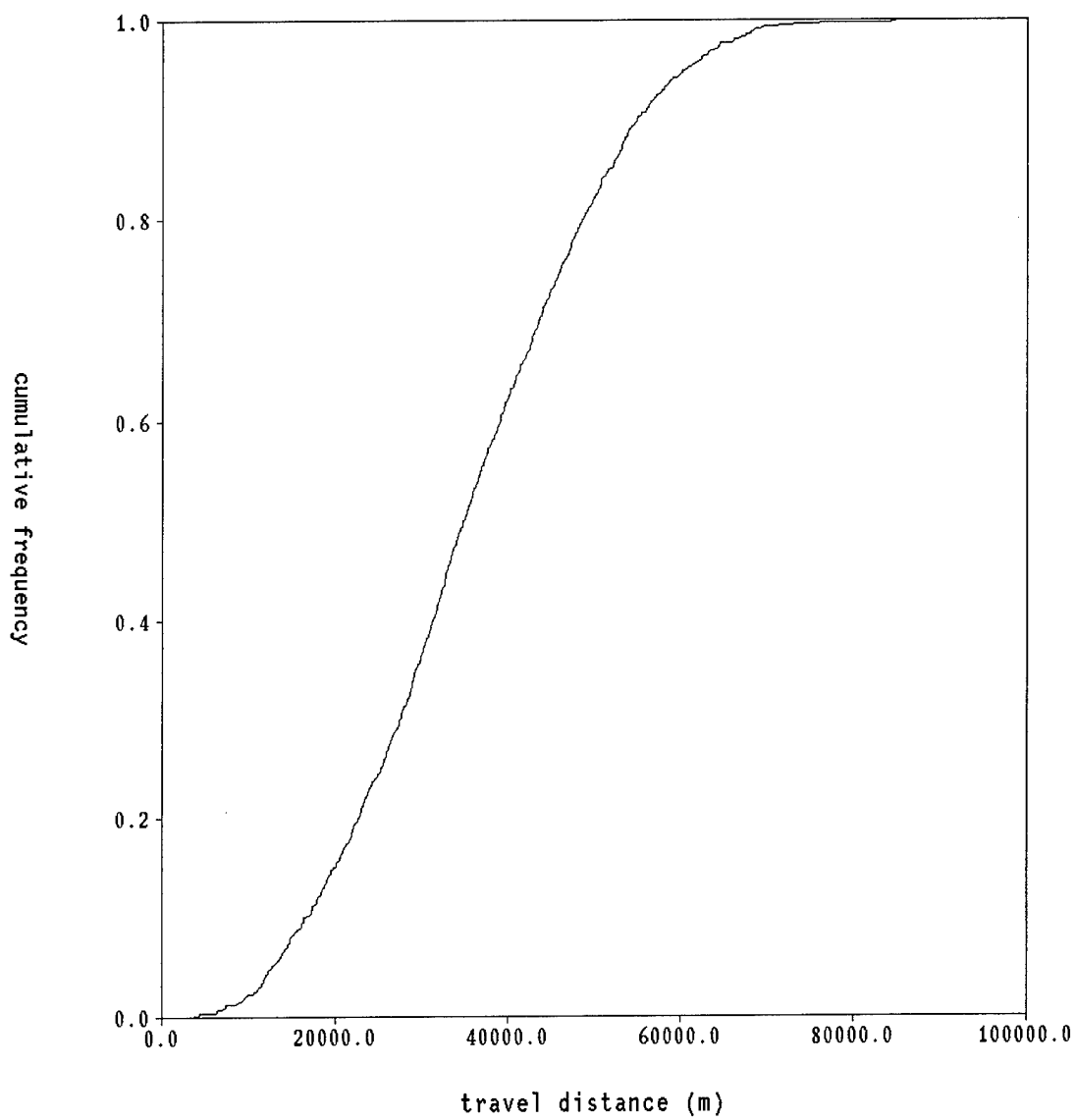


**Figure A-41. Travel Distance, Pokang, 5 km**

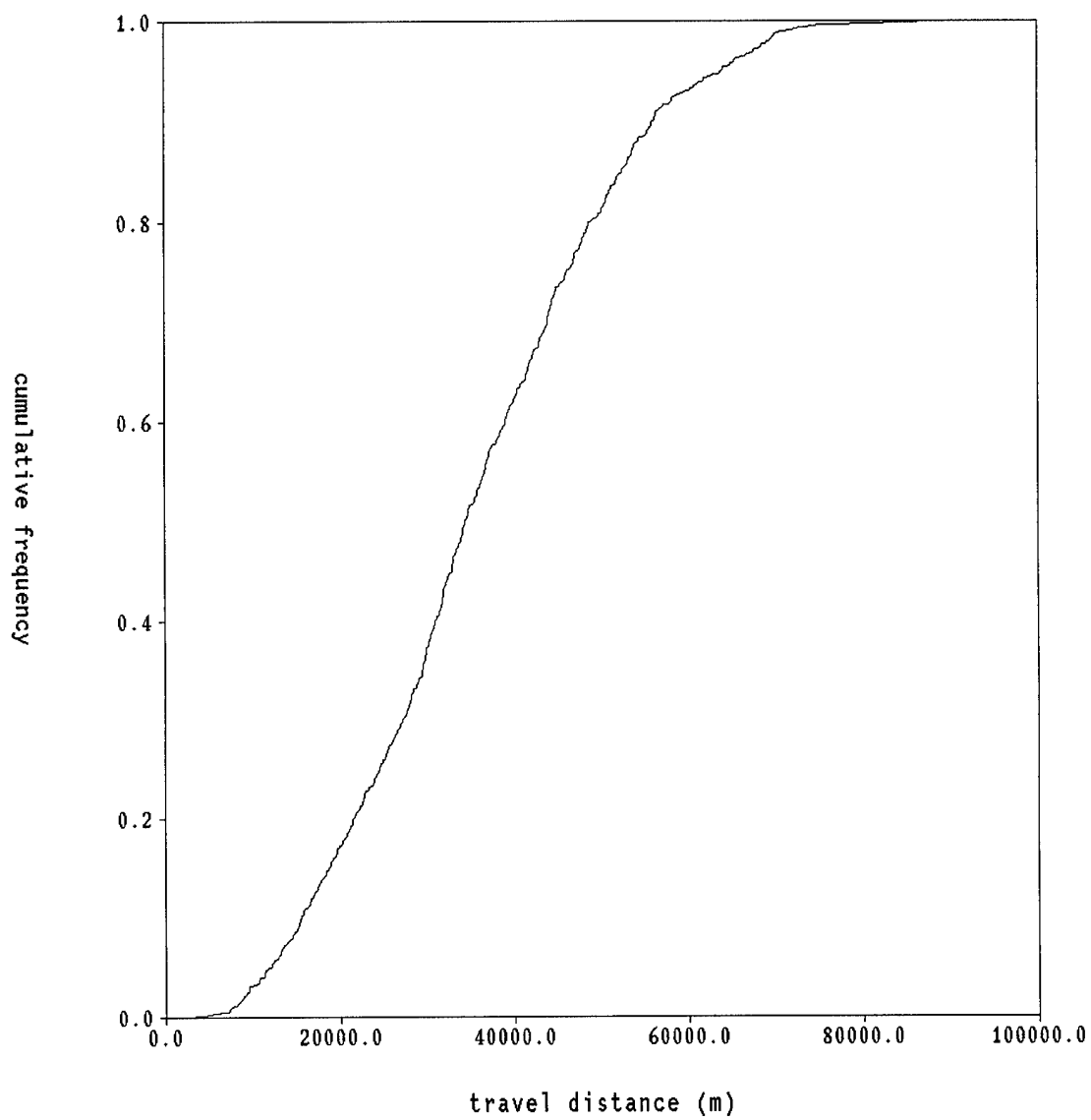




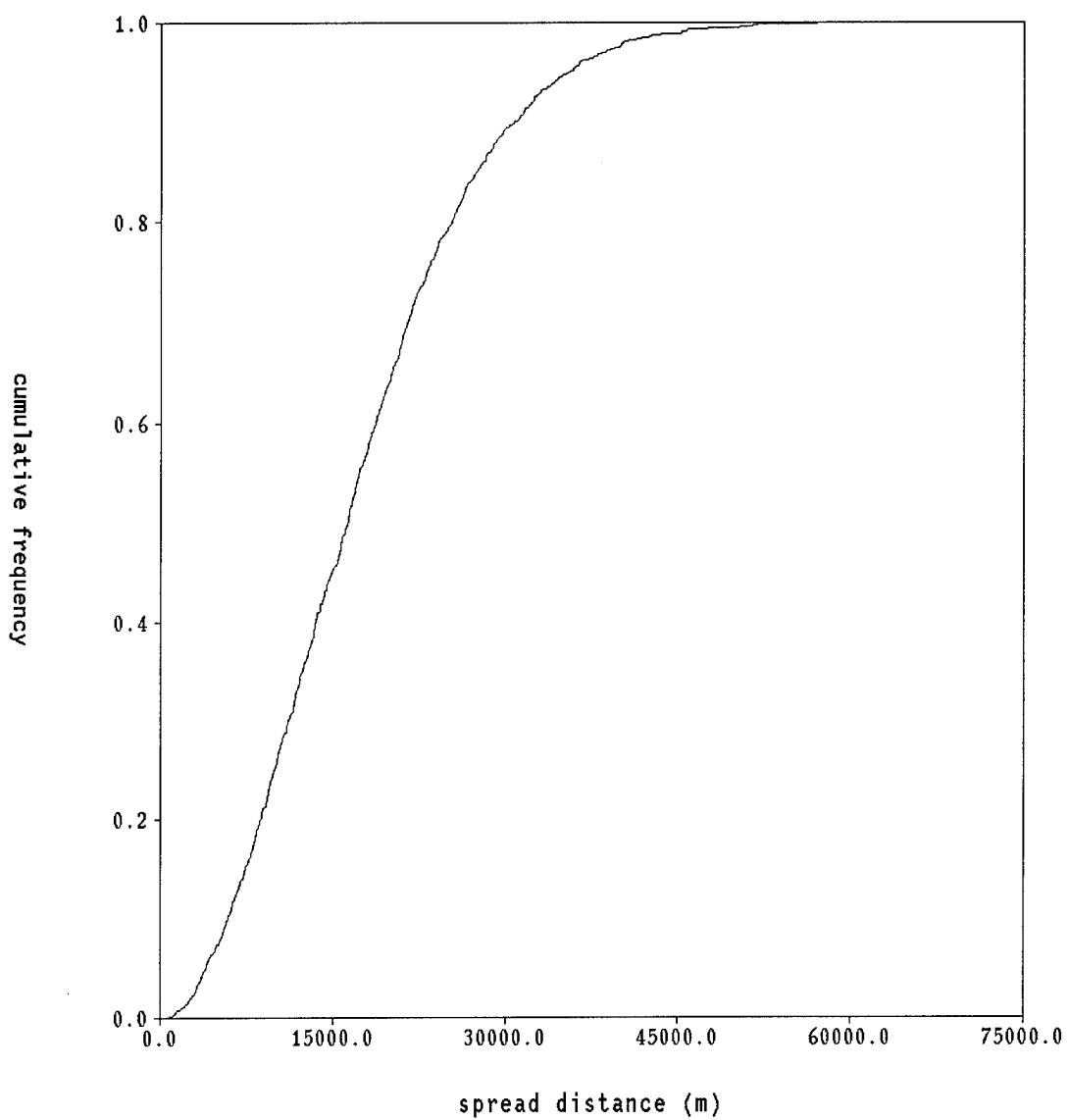
**Figure A-42. Travel Distance, Pokang, 10 km**



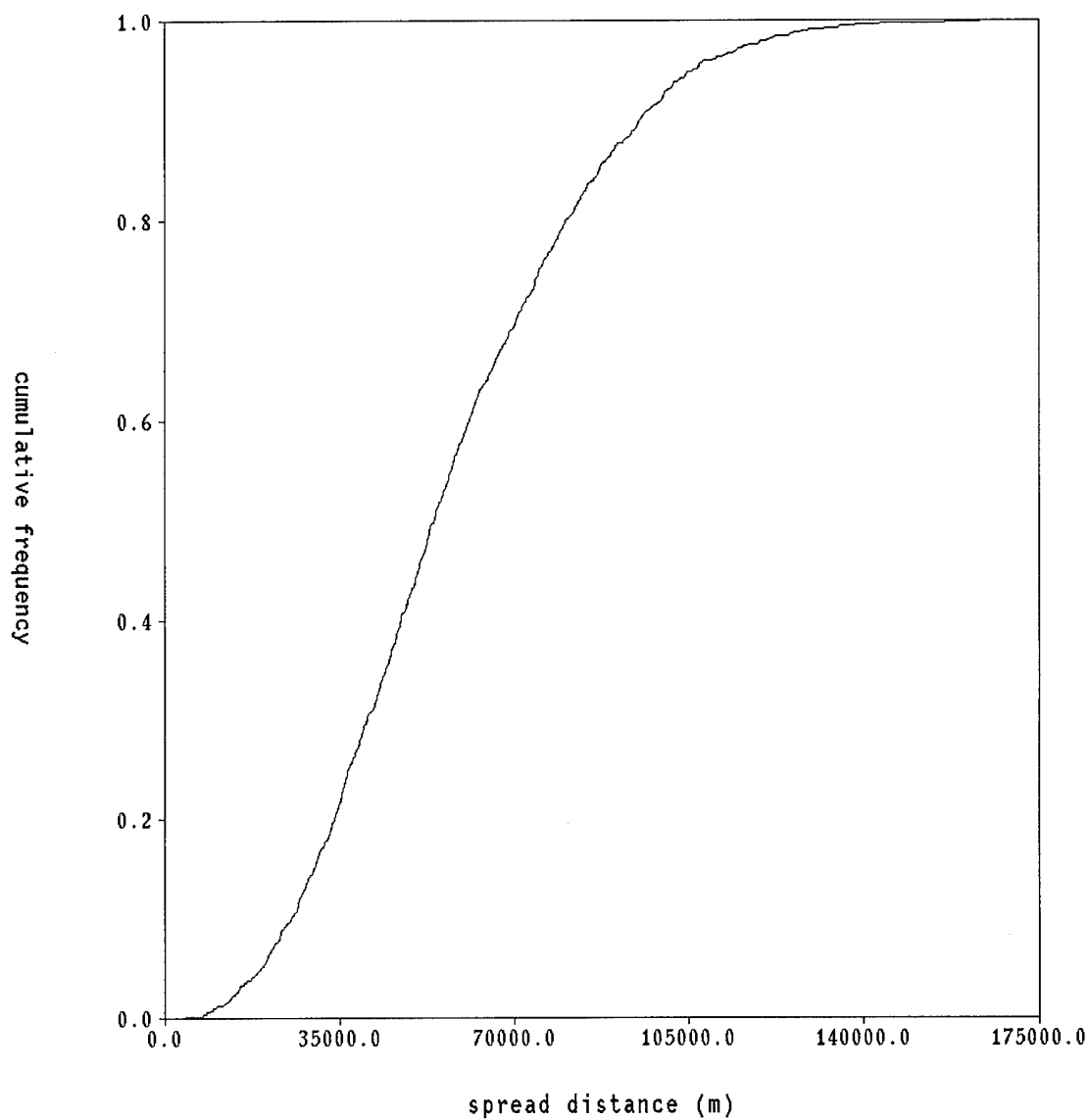
**Figure A-43. Travel Distance, Pokang, 20 km**



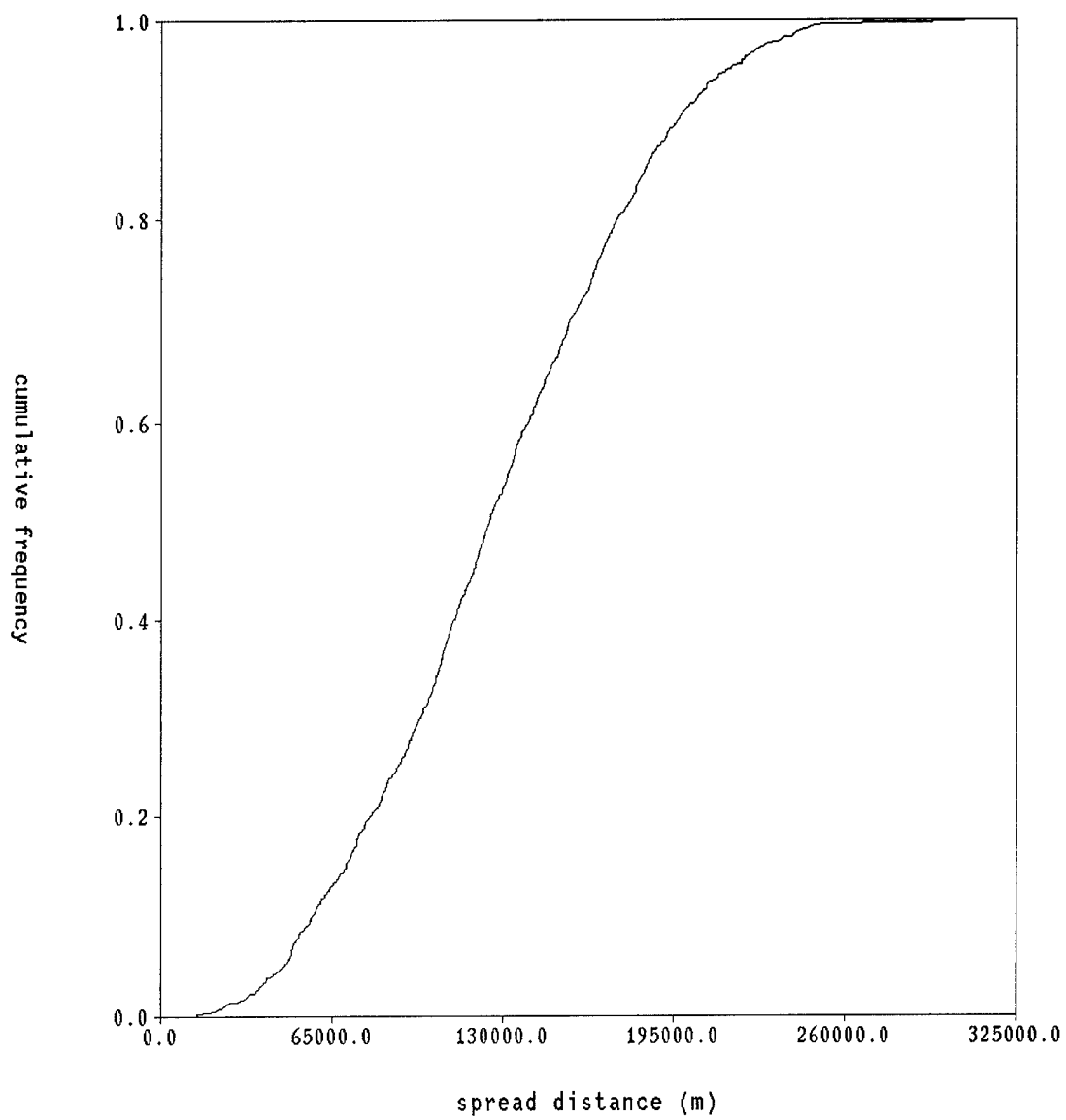
**Figure A-44. Travel Distance, Pokang, 30 km**



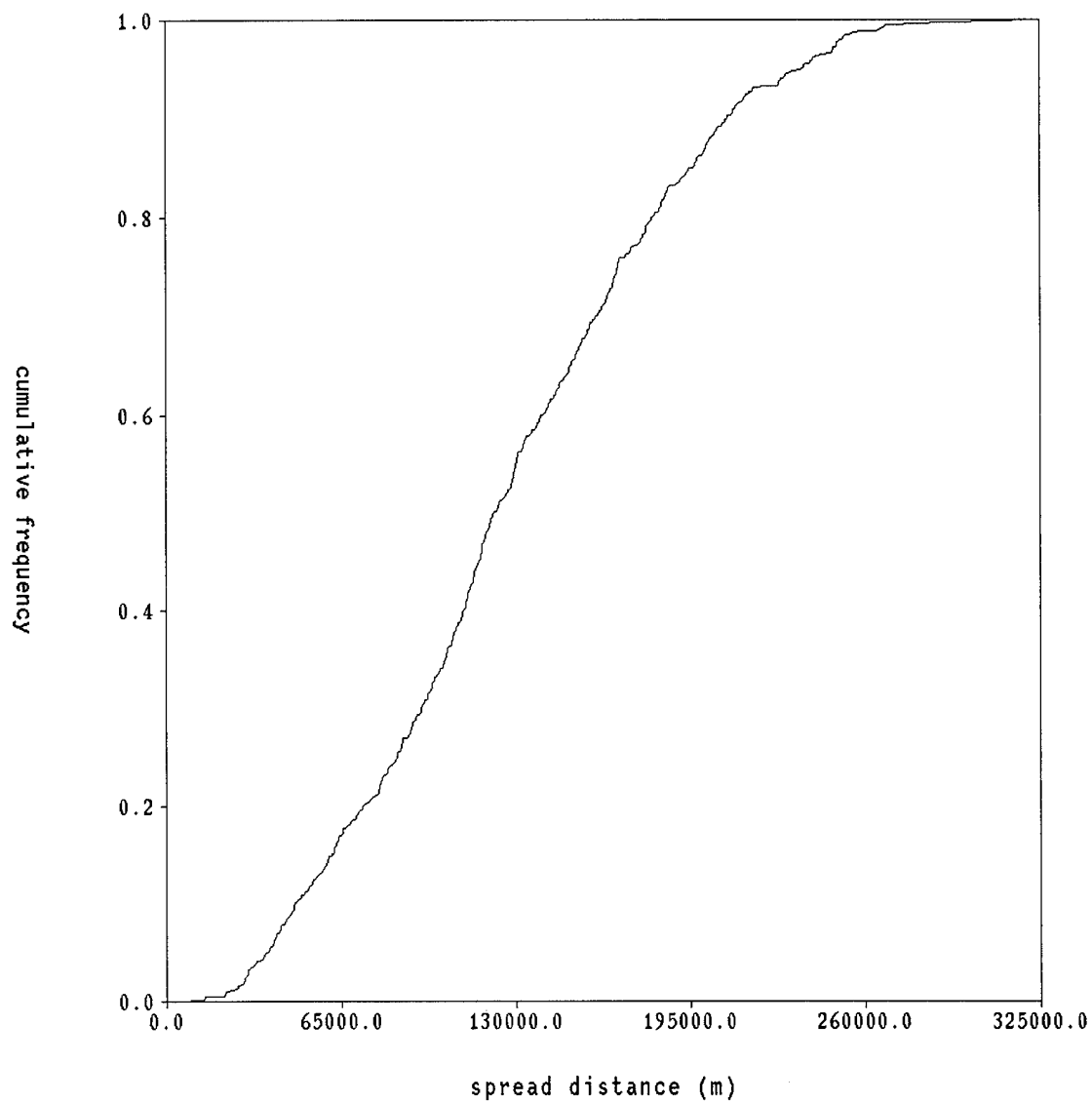
**Figure A-45. Spread Distance, Pokang, 5 km**



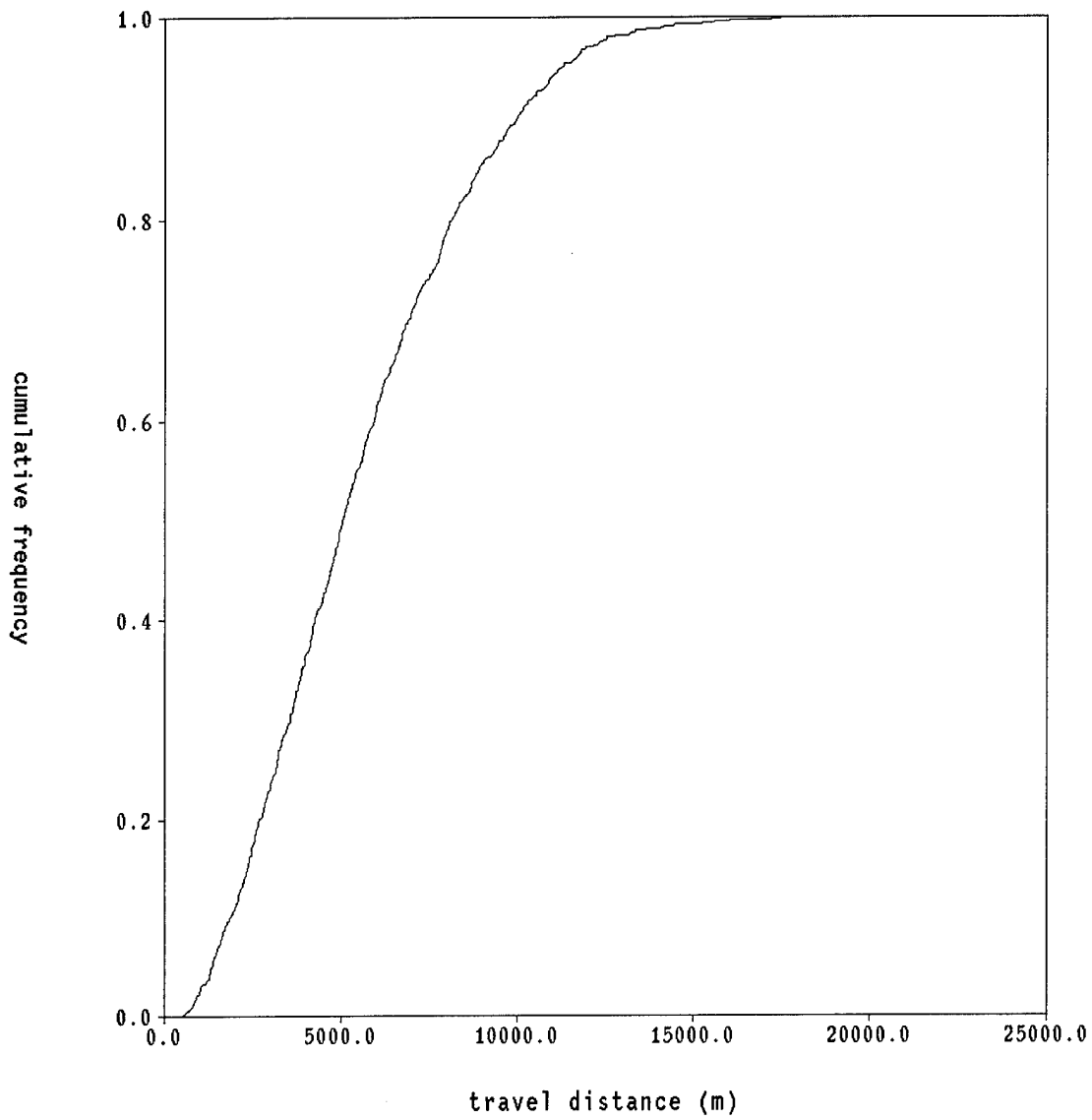
**Figure A-46. Spread Distance, Pokang, 10 km**



**Figure A-47. Spread Distance, Pokang, 20 km**

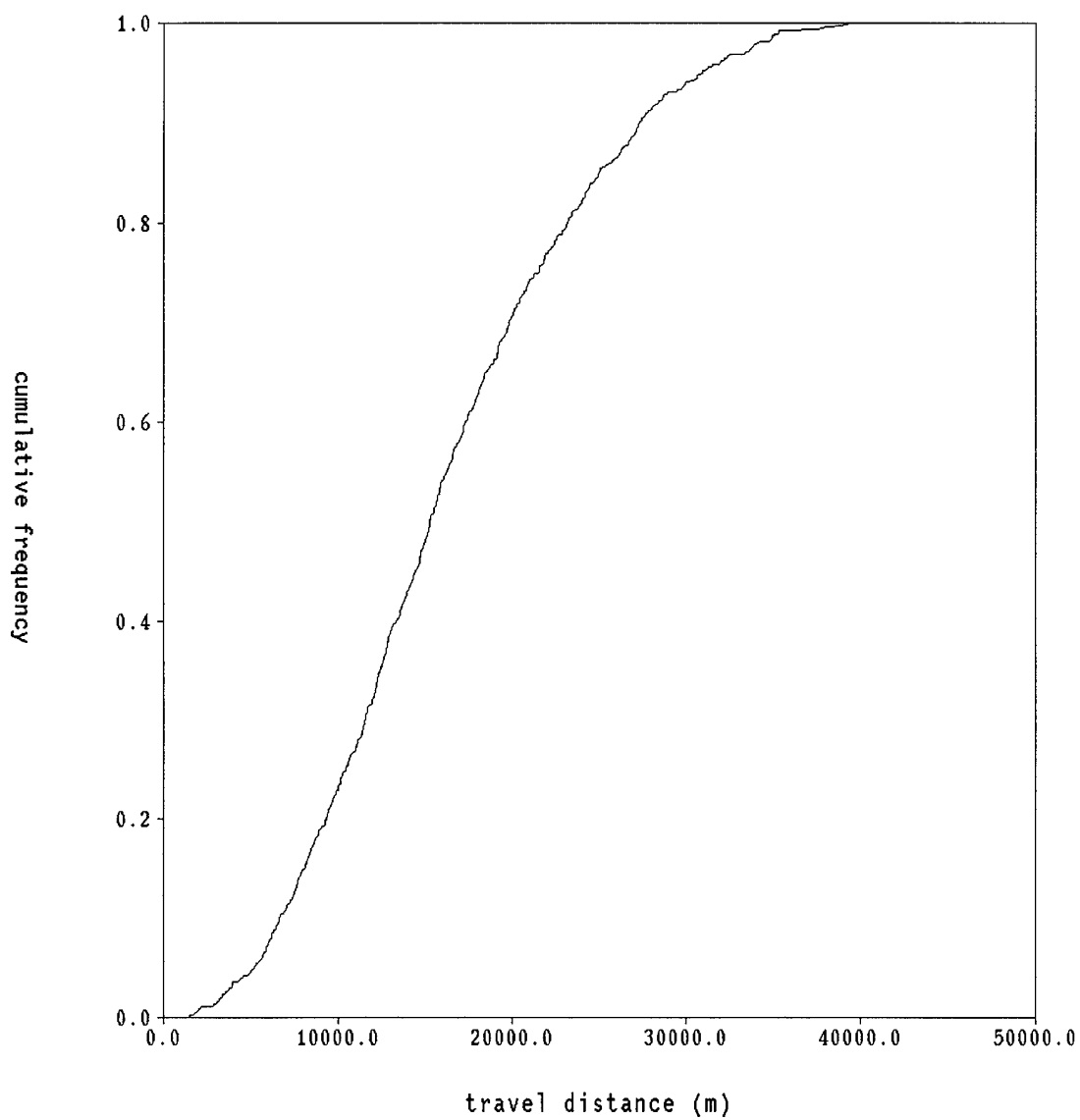


**Figure A-48. Spread Distance, Pokang, 30 km**

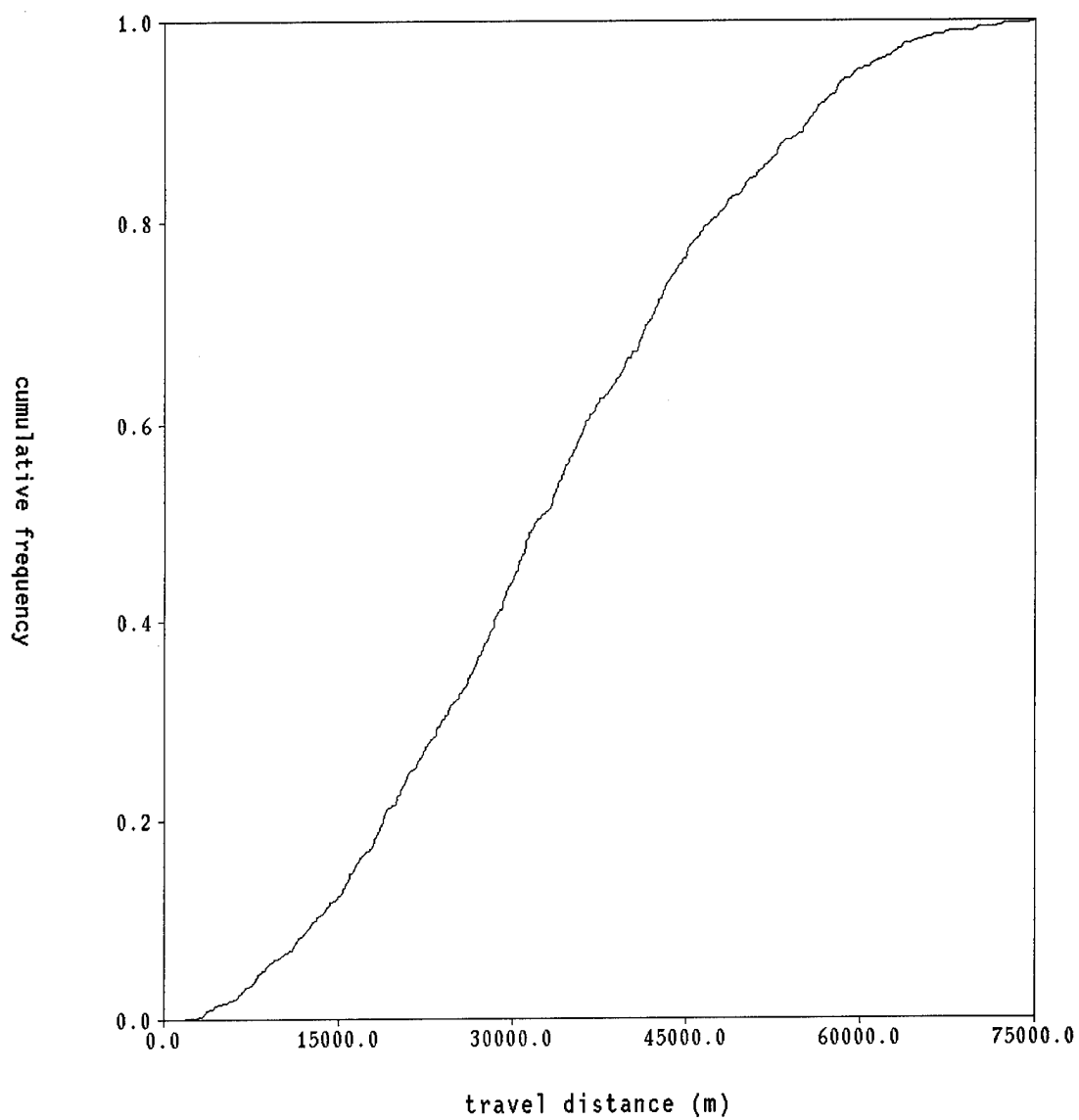


**Figure A-49. Travel Distance, Cheju, 5 km**

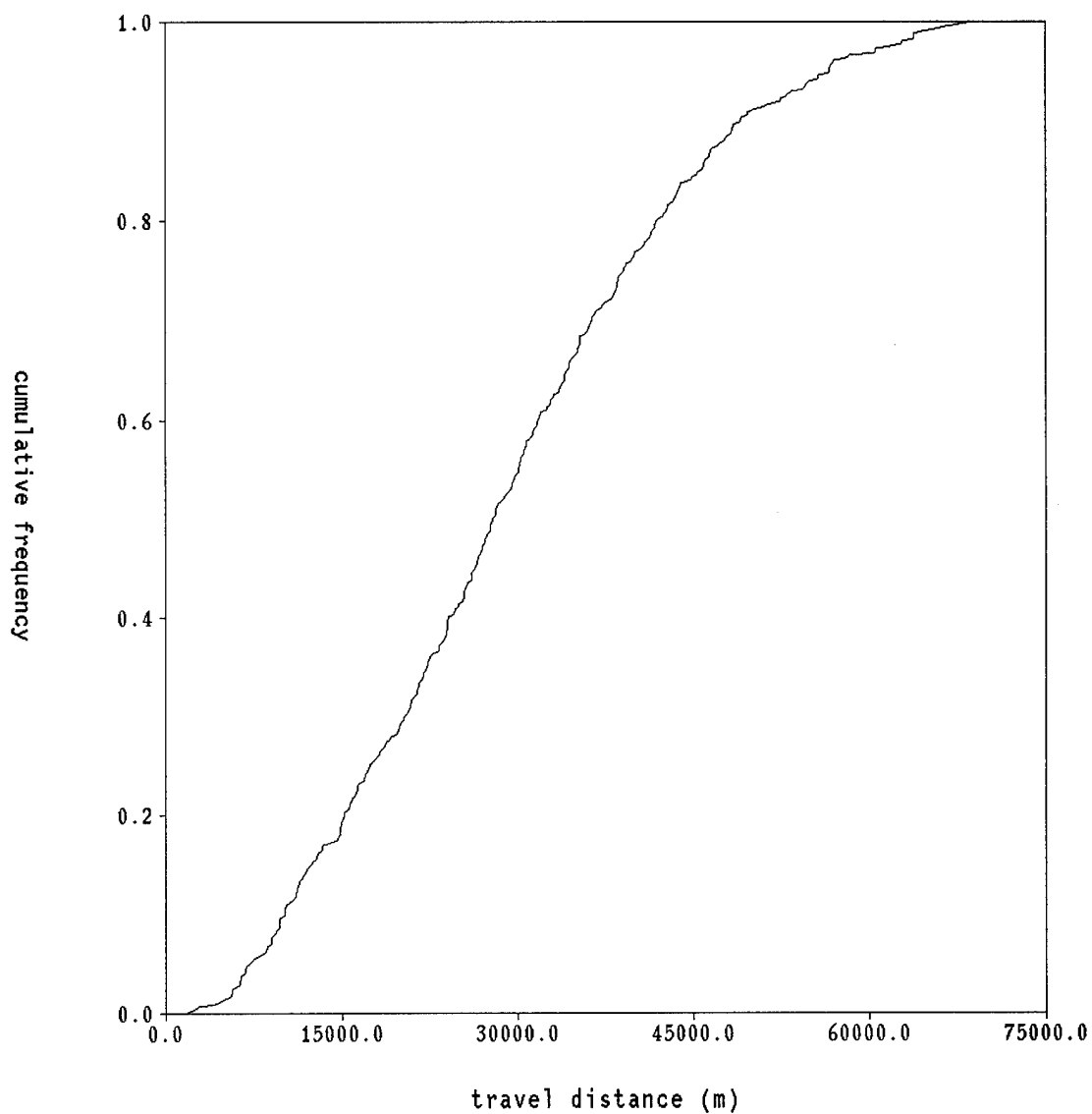




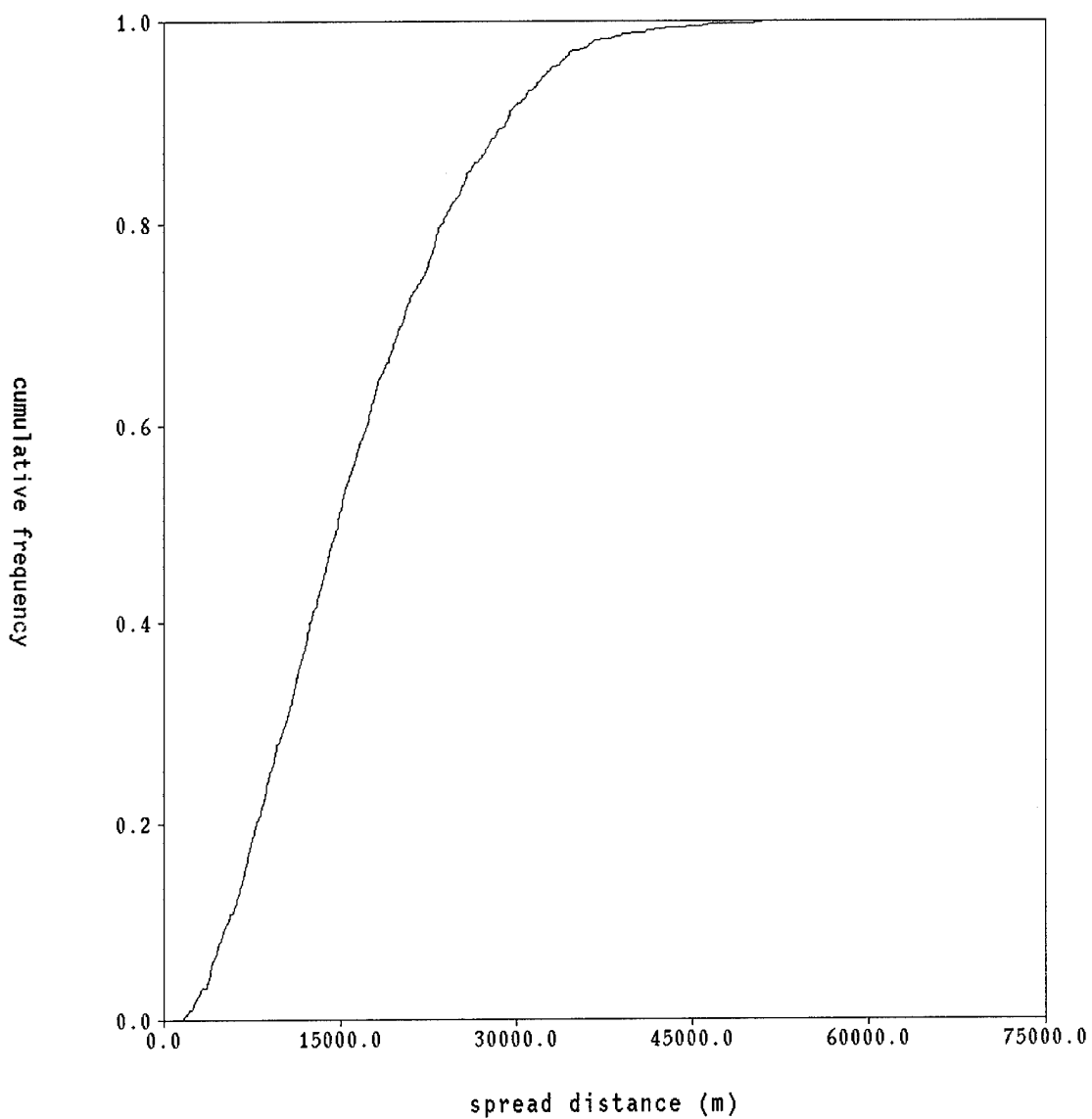
**Figure A-50. Travel Distance, Cheju, 10 km**



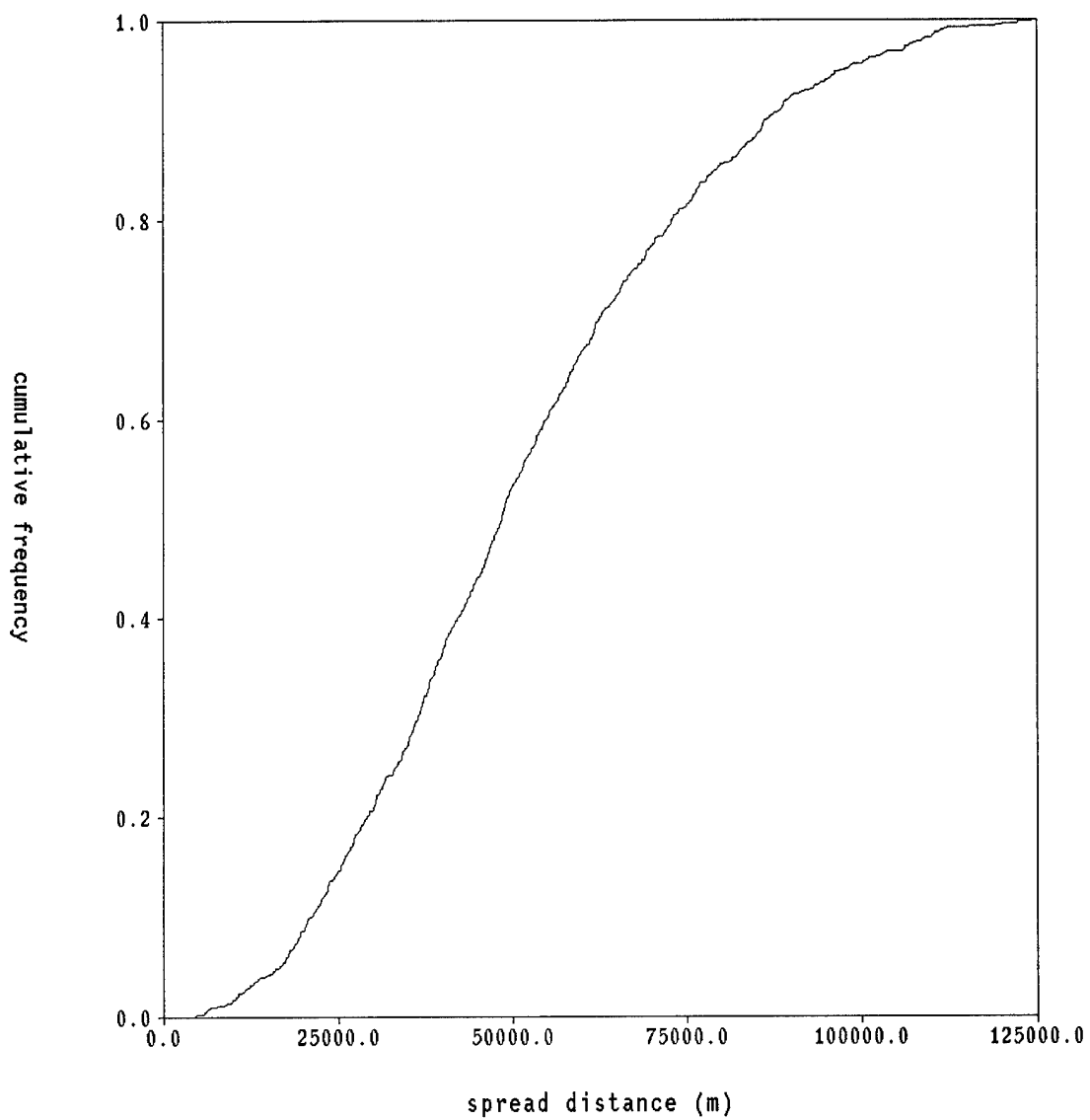
**Figure A-51. Travel Distance, Cheju, 20 km**



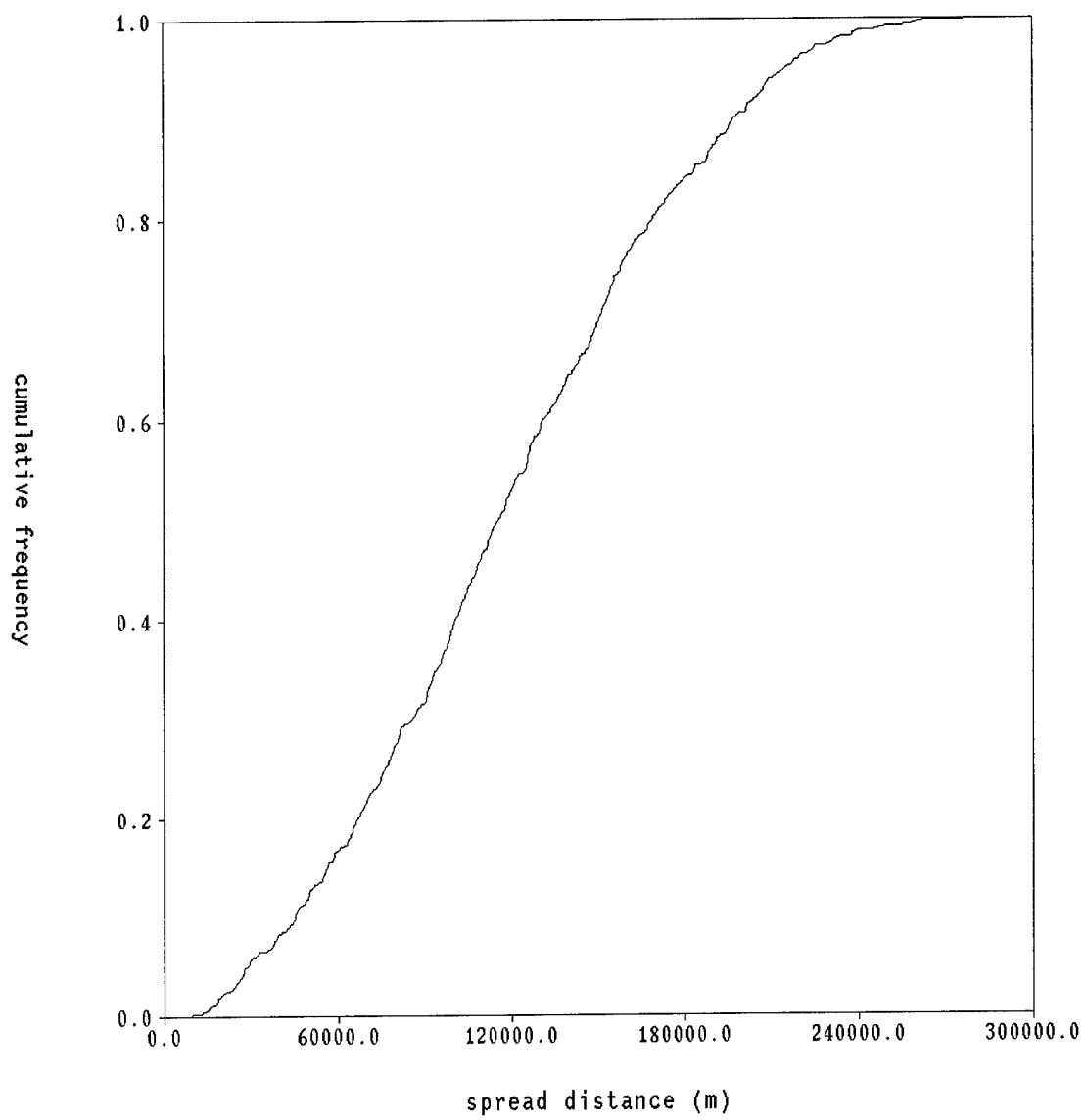
**Figure A-52. Travel Distance, Cheju, 30 km**



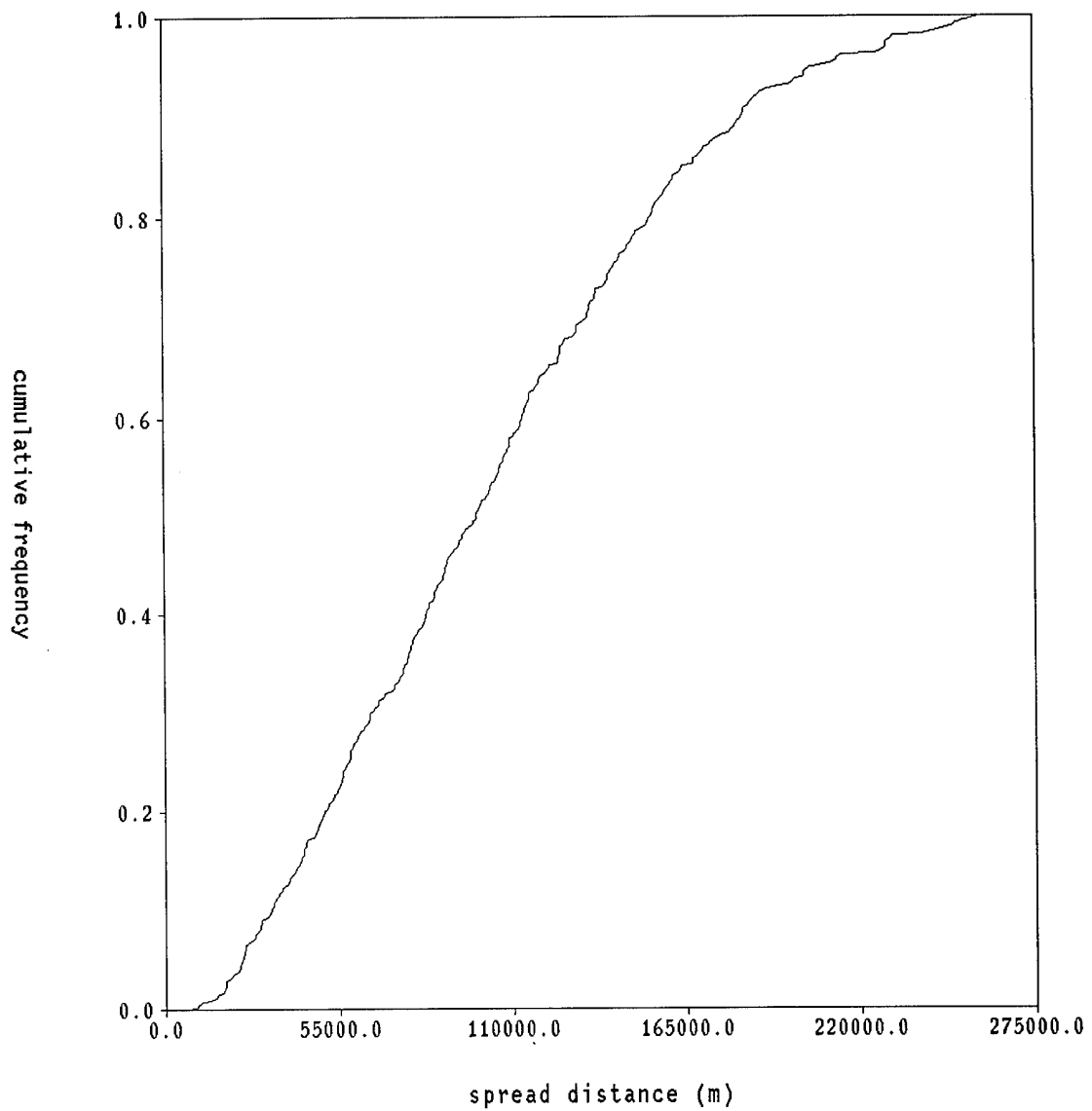
**Figure A-53. Spread Distance, Cheju, 5 km**



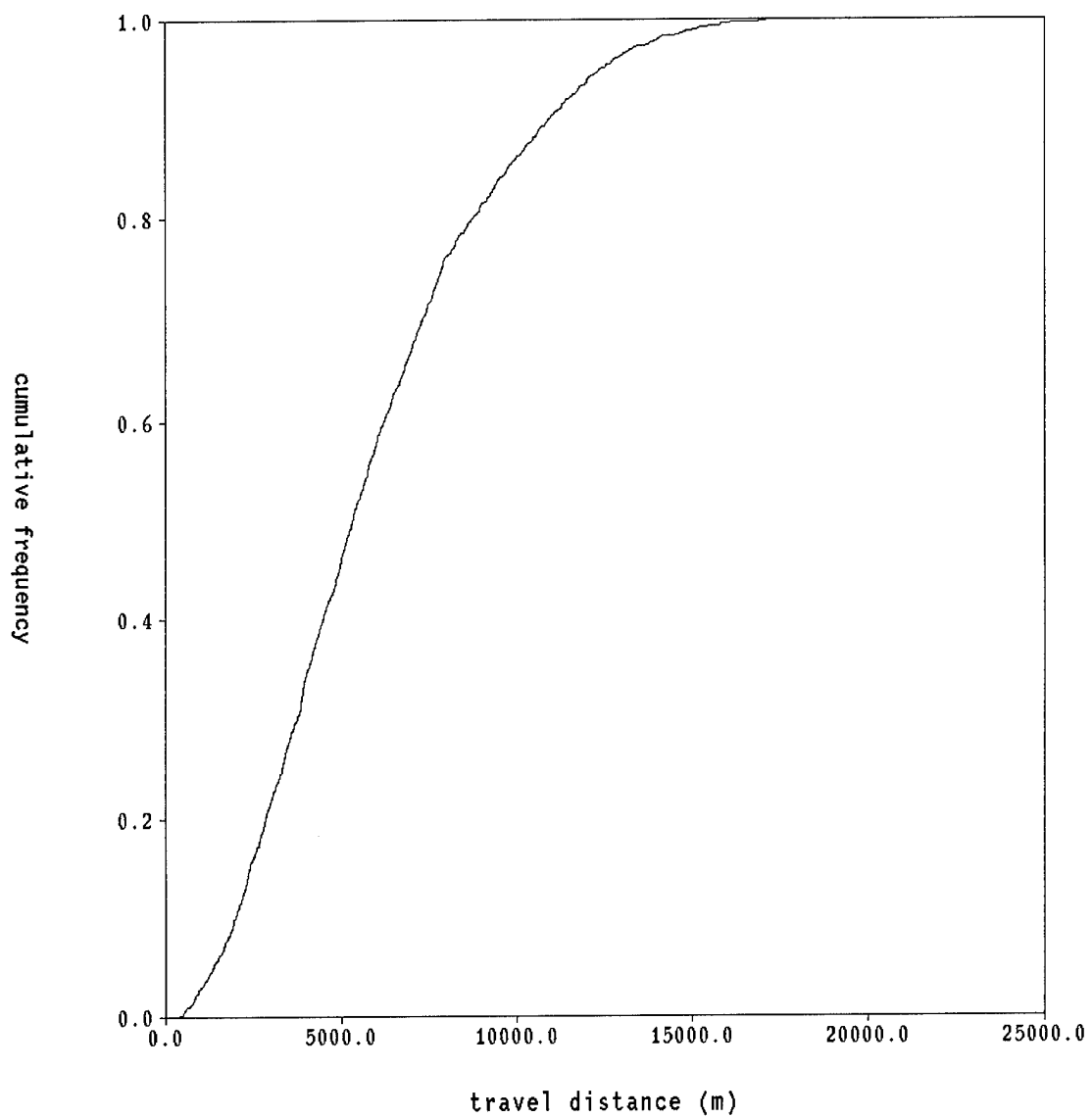
**Figure A-54. Spread Distance, Cheju, 10 km**



**Figure A-55. Spread Distance, Cheju, 20 km**

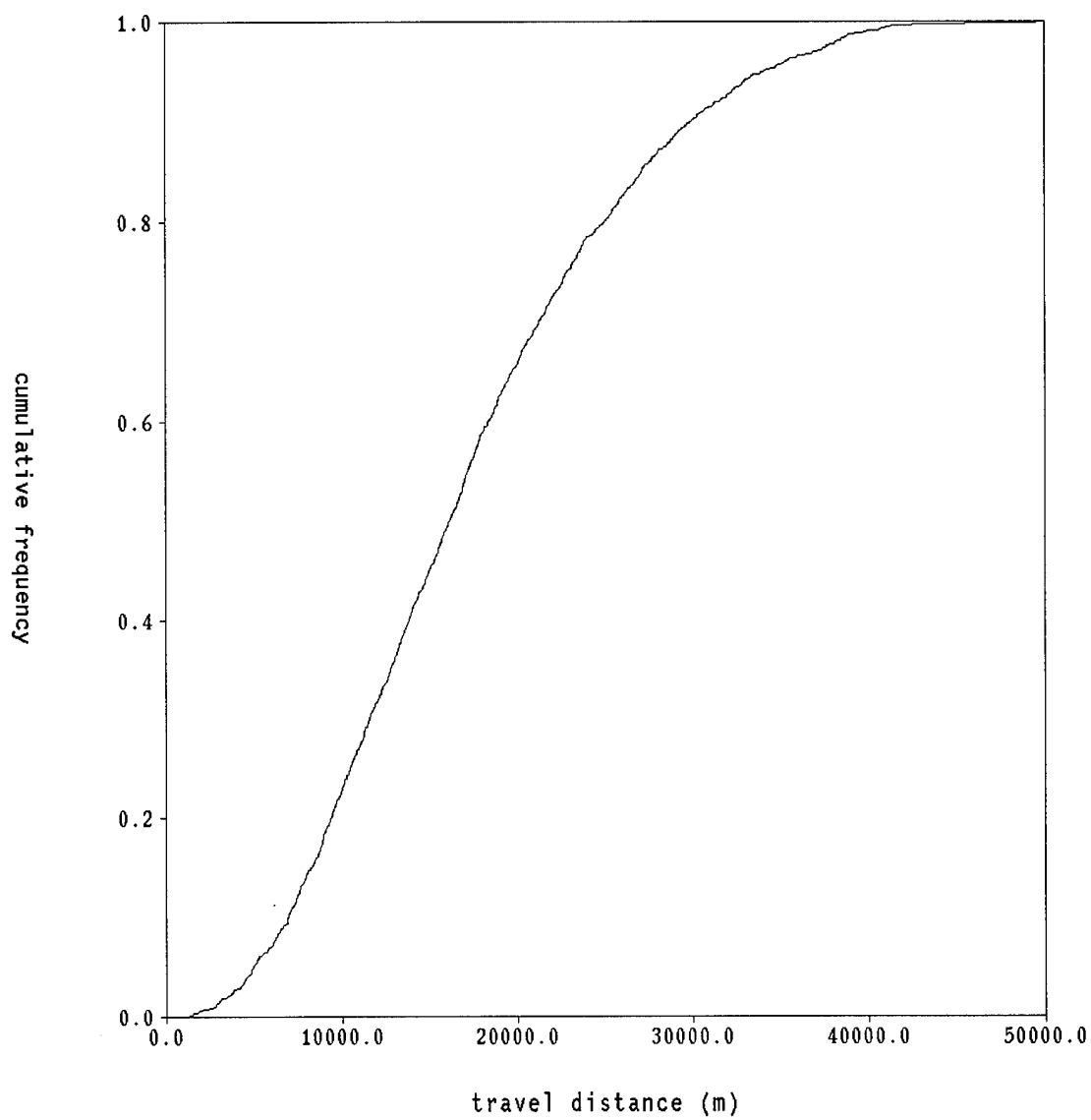


**Figure A-56. Spread Distance, Cheju, 30 km**

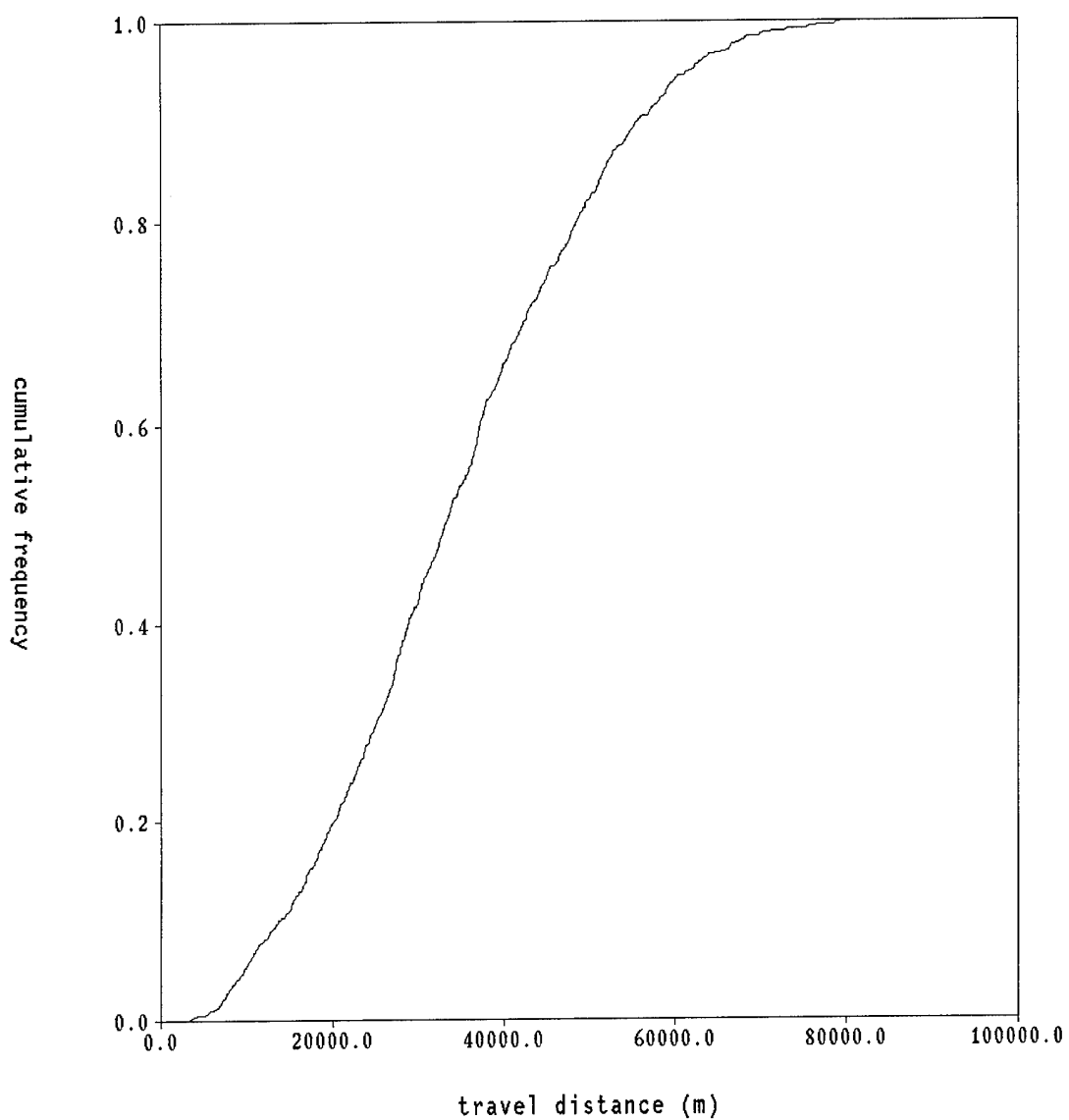


**Figure A-57. Travel Distance, Kwanju, 5 km**

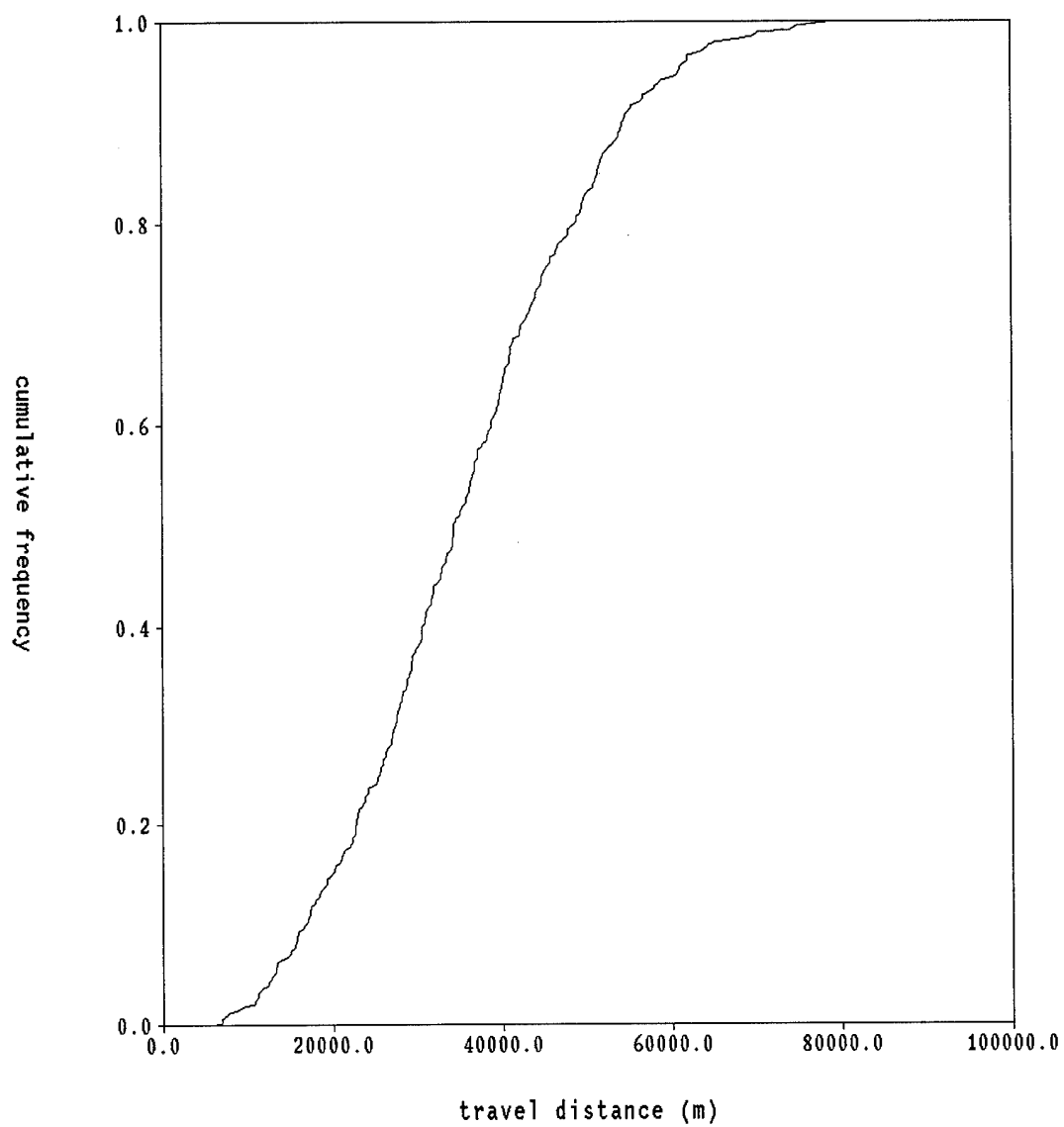




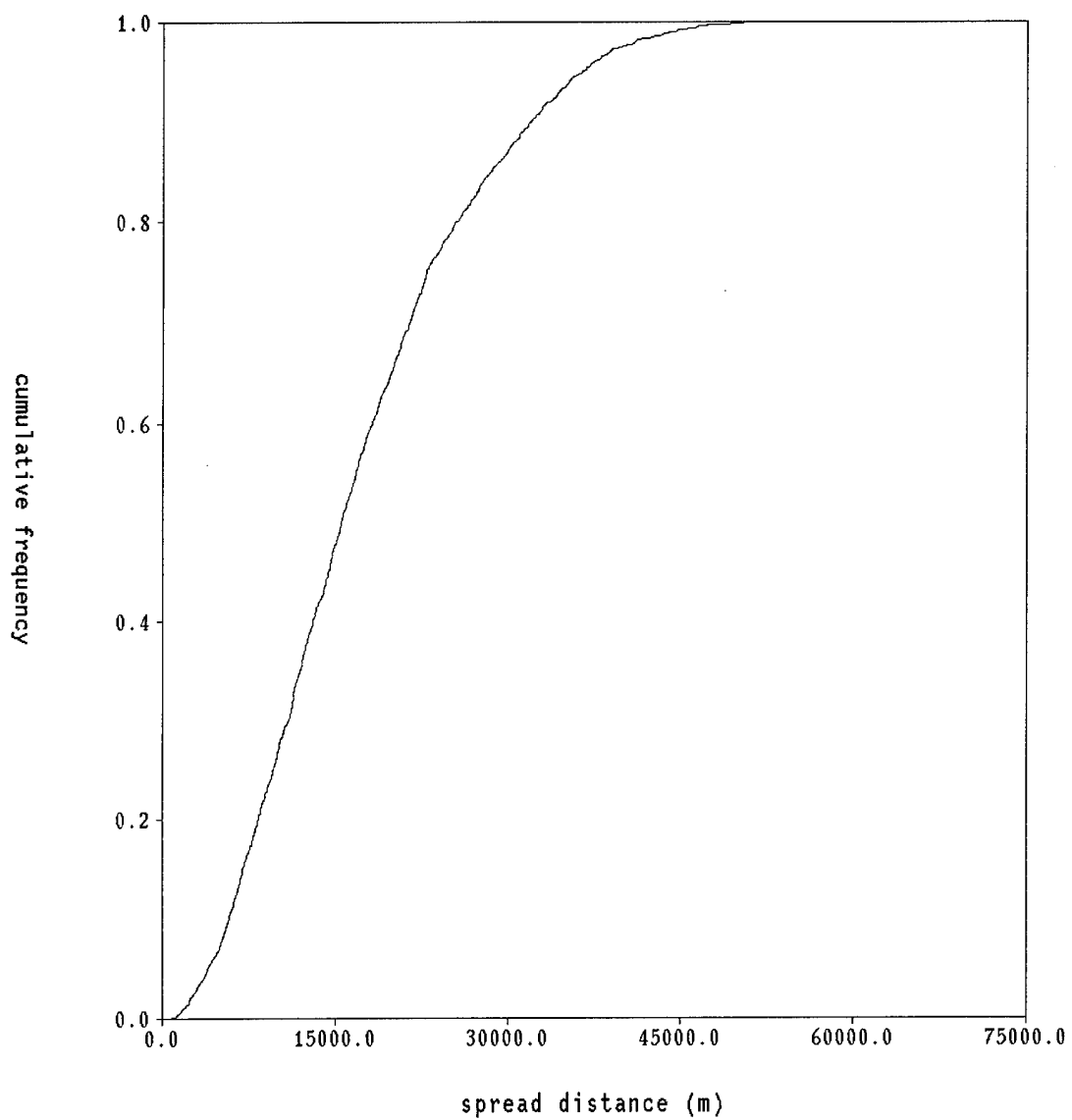
**Figure A-58. Travel Distance, Kwanju, 10 km**



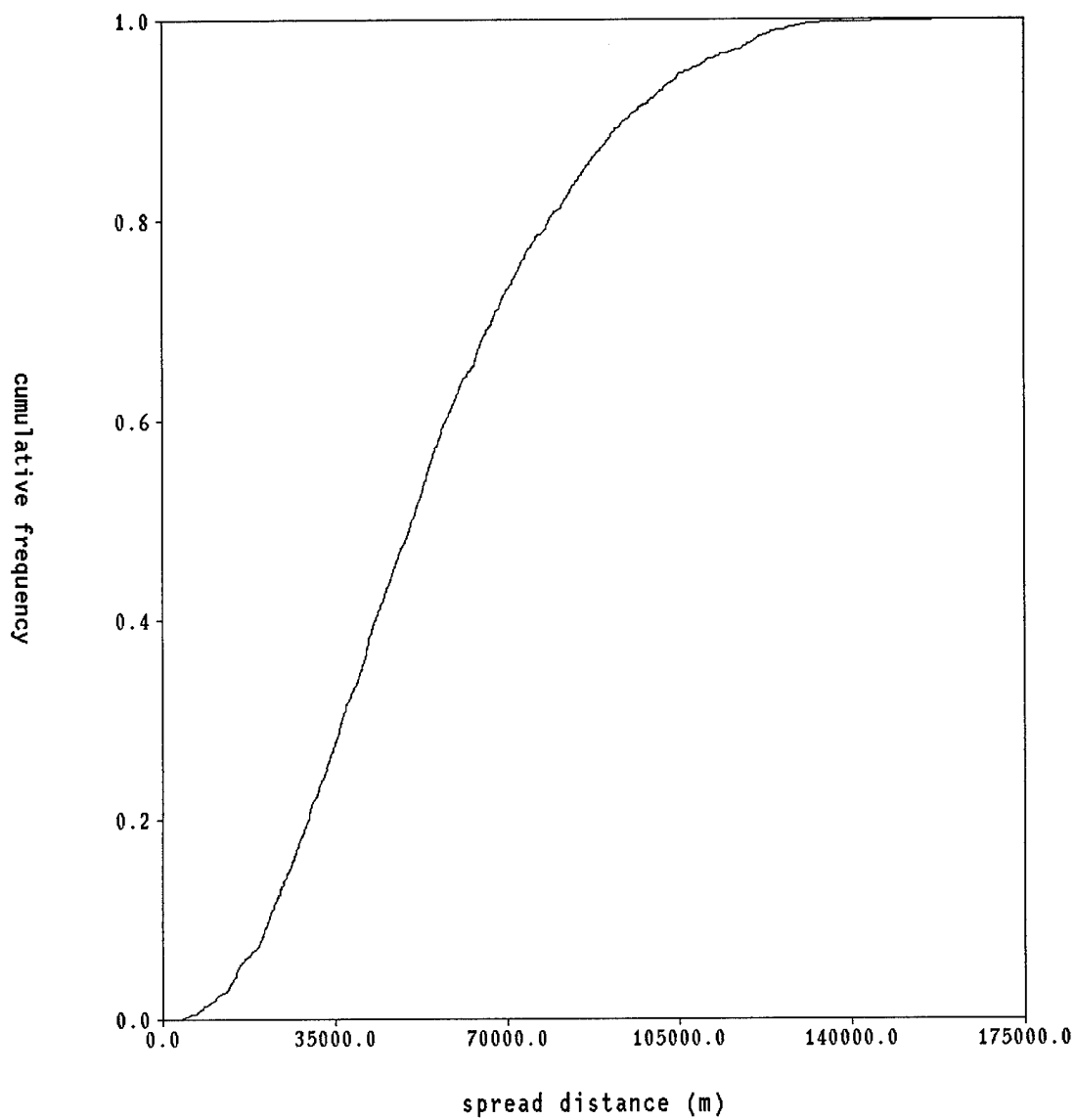
**Figure A-59. Travel Distance, Kwanju, 20 km**



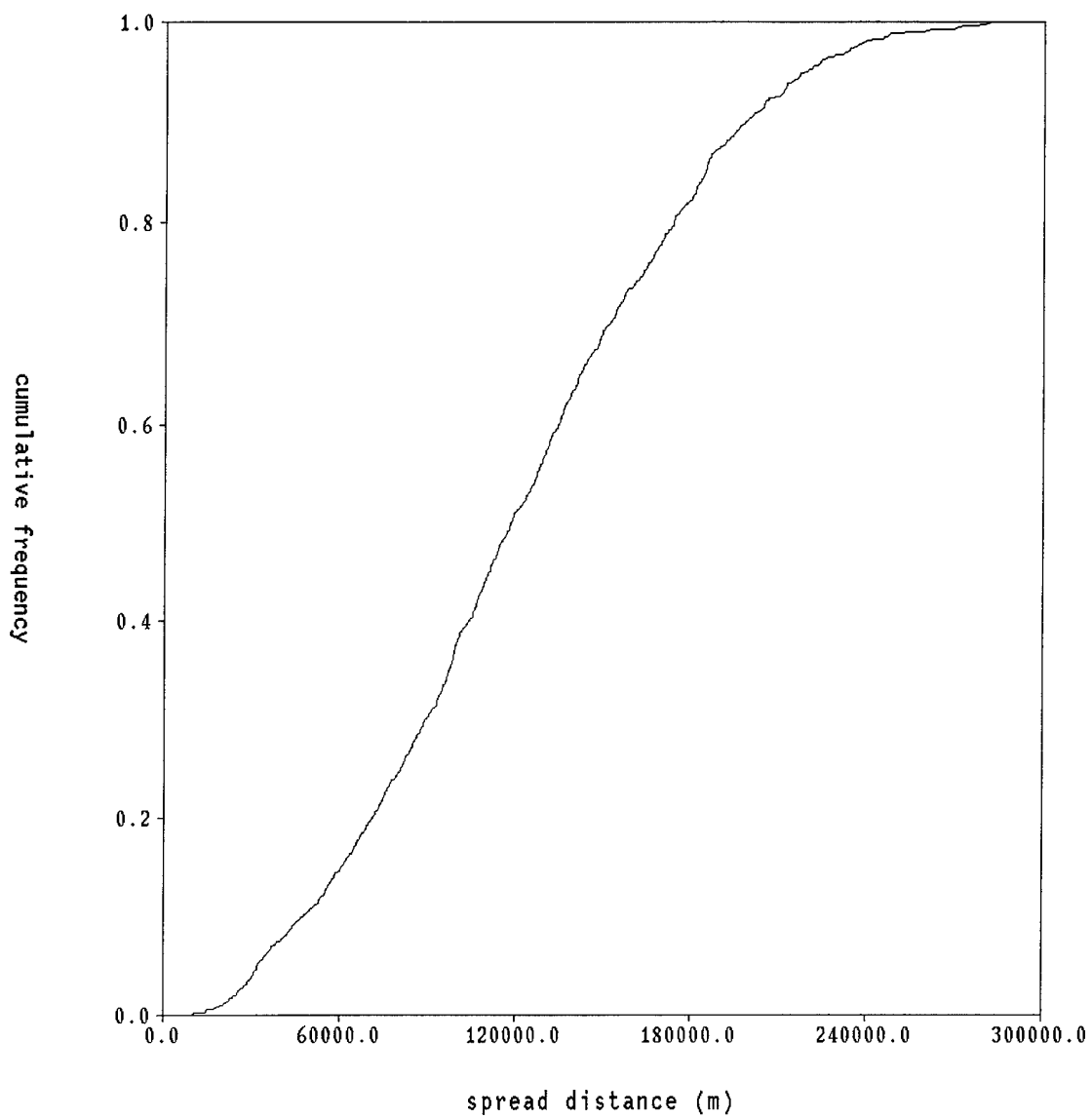
**Figure A-60. Travel Distance, Kwanju, 30 km**



**Figure A-61. Spread Distance, Kwanju, 5 km**



**Figure A-62. Spread Distance, Kwanju, 10 km**



**Figure A-63. Spread Distance, Kwanju, 20 km**

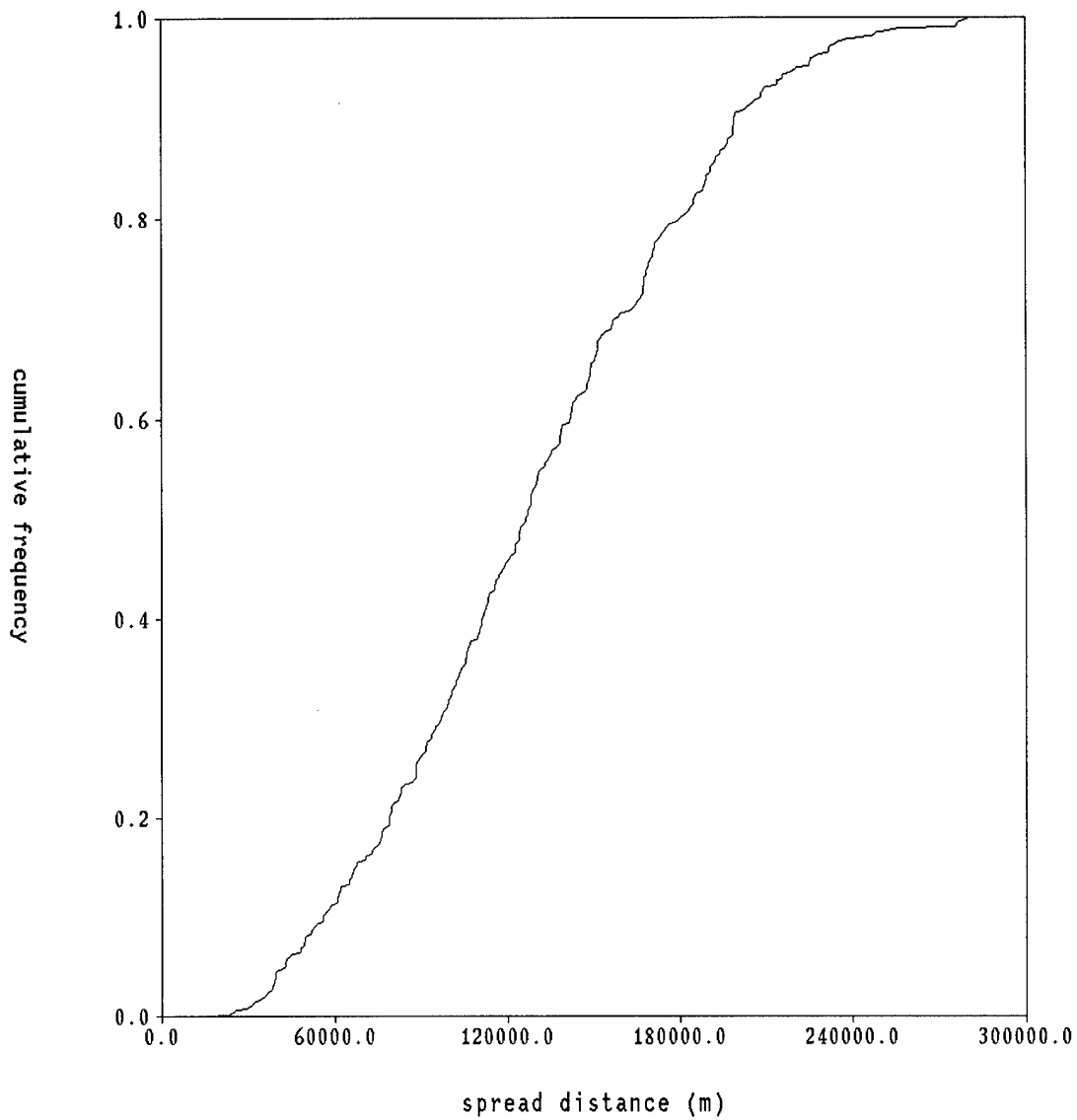
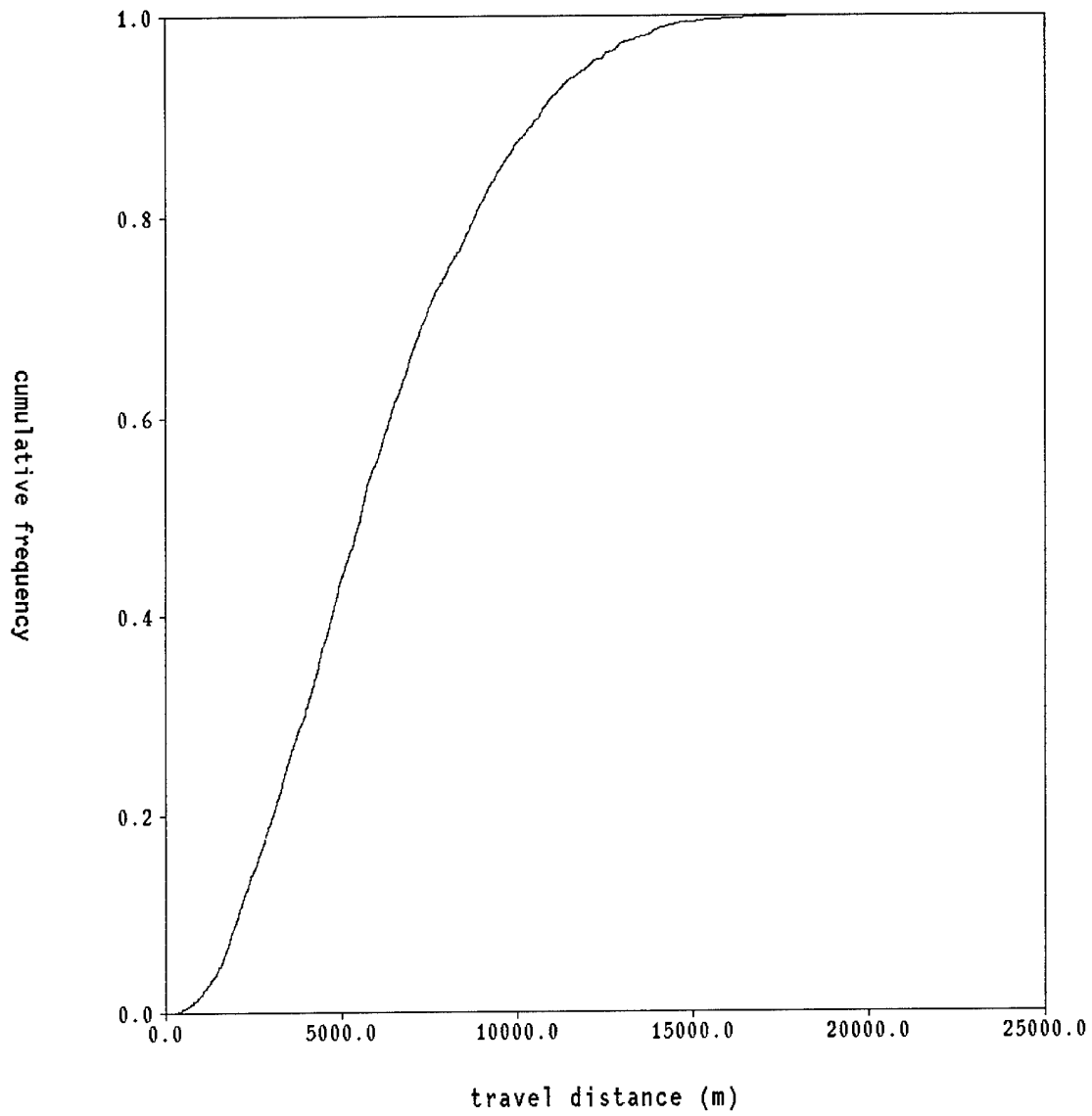
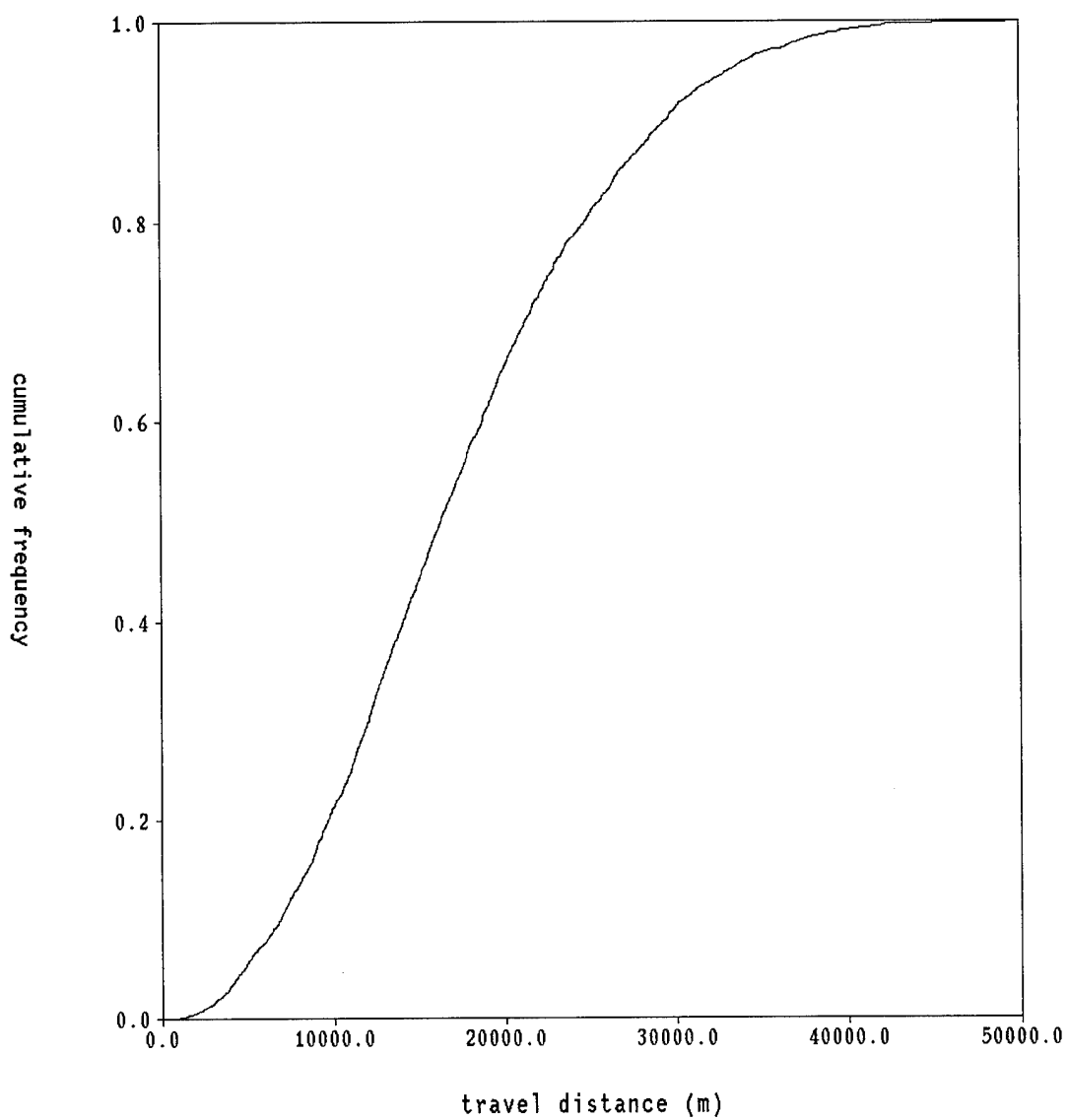


Figure A-64. Spread Distance, Kwanju, 30 km

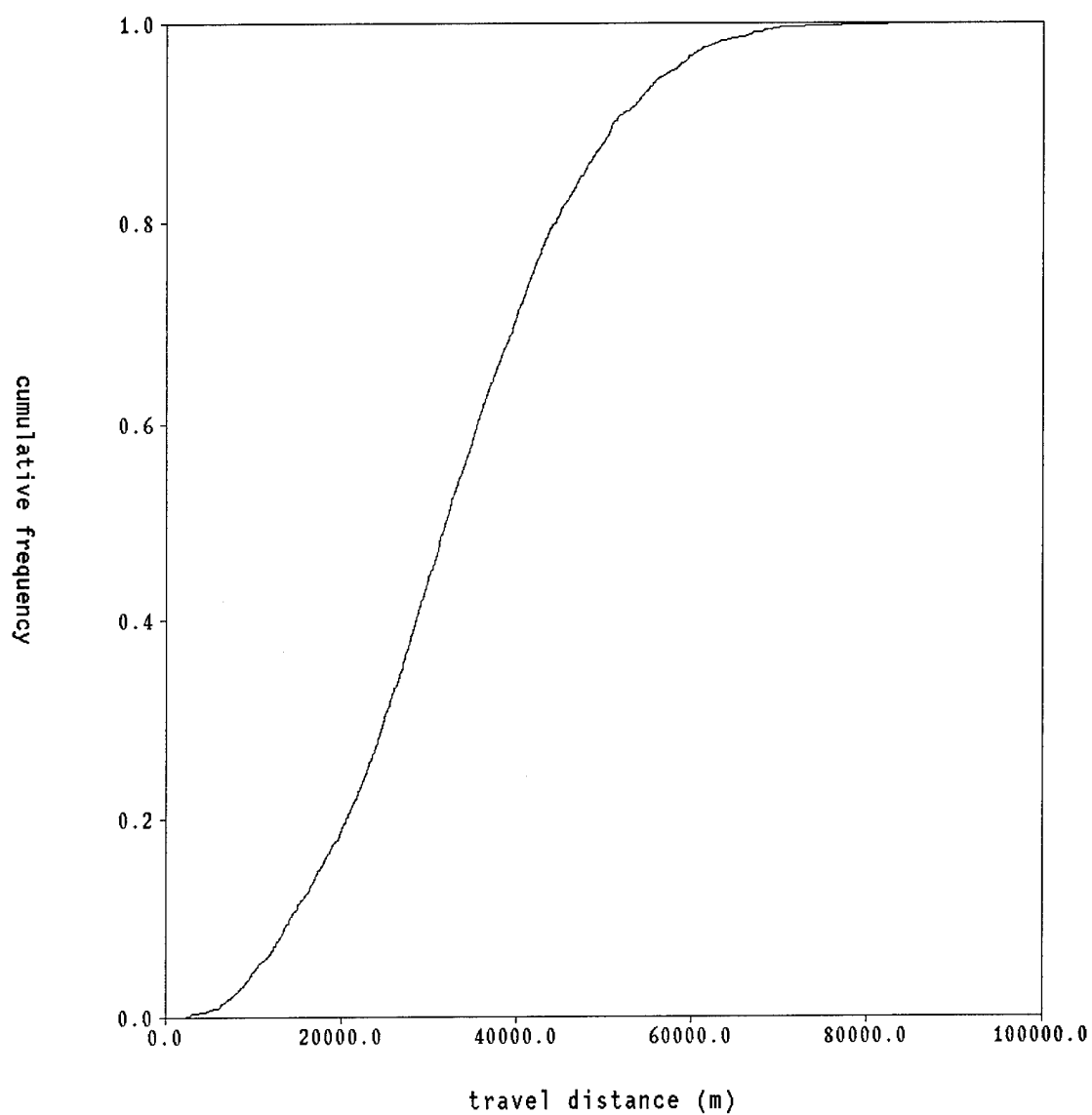


**Figure A-65. Travel Distance, Osan, 5 km**

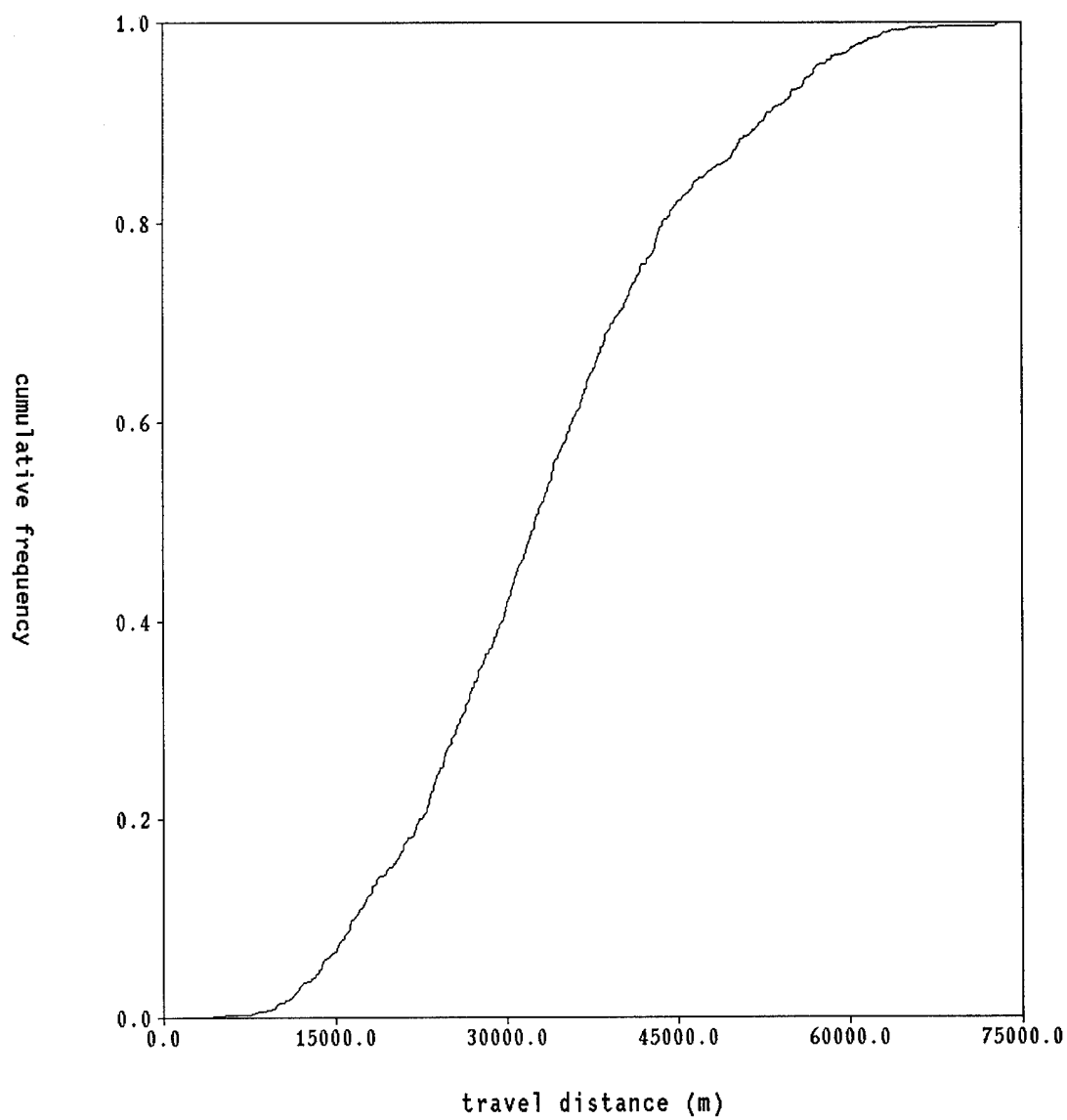




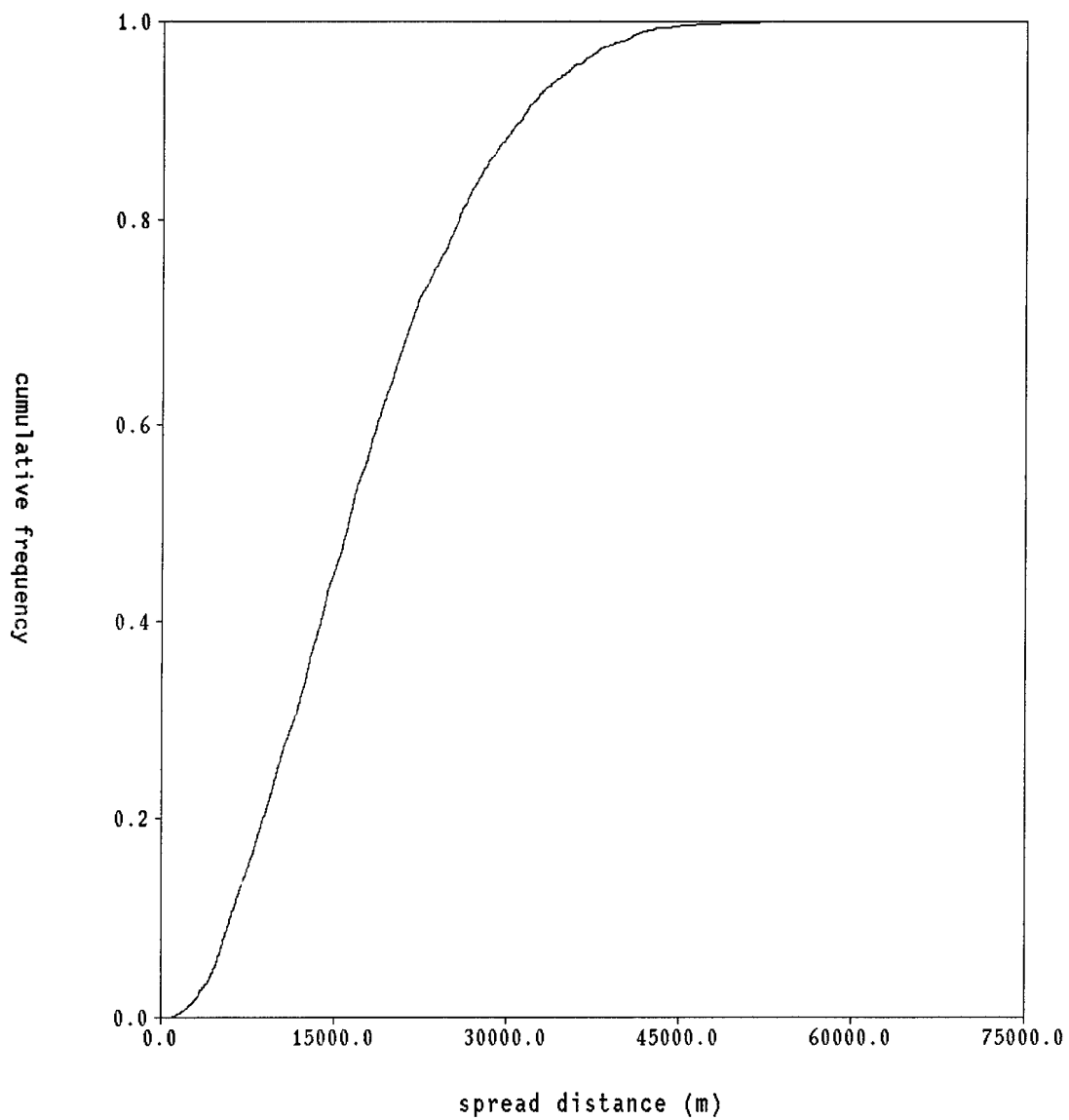
**Figure A-66. Travel Distance, Osan, 10 km**



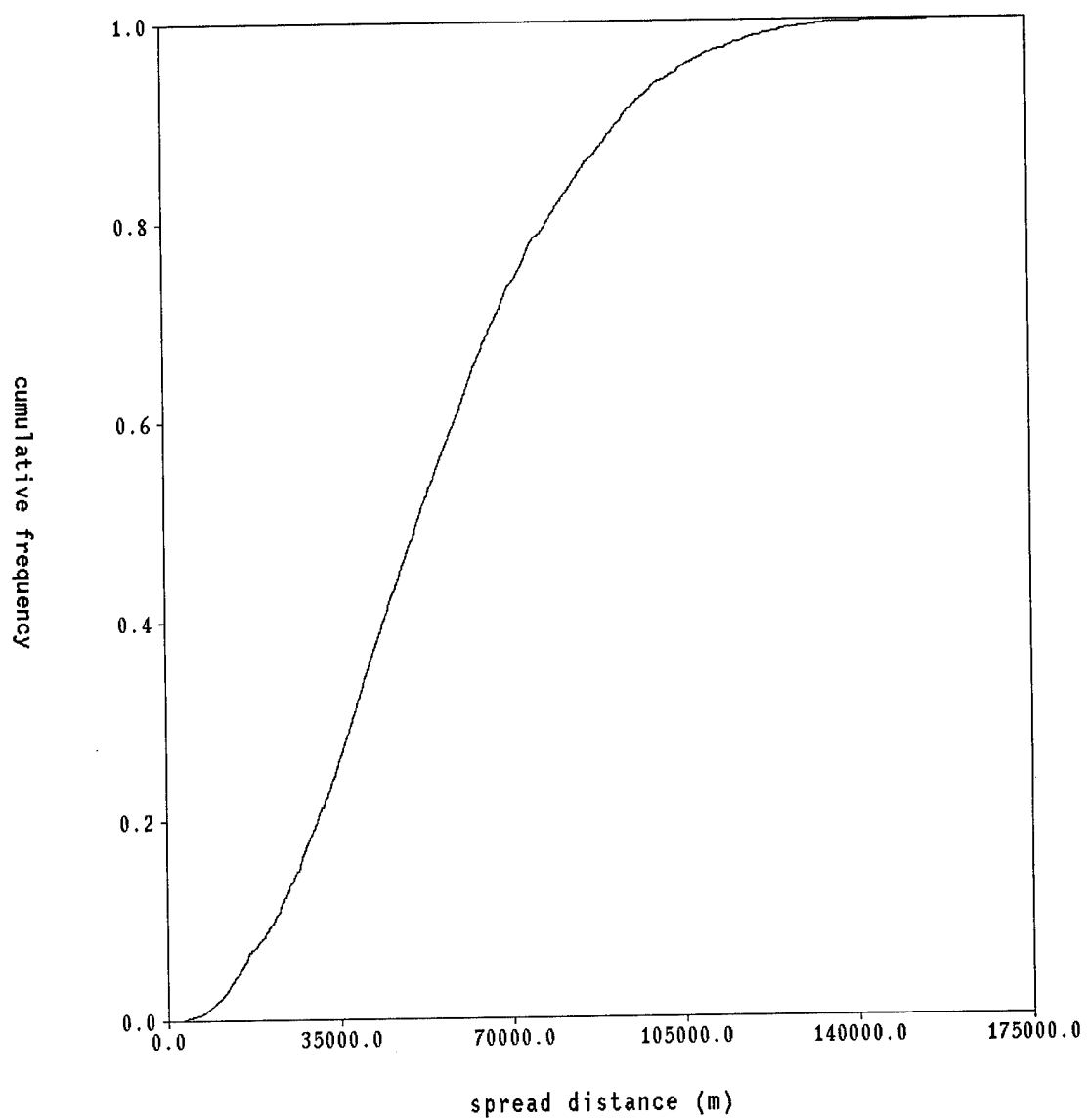
**Figure A-67. Travel Distance, Osan, 20 km**



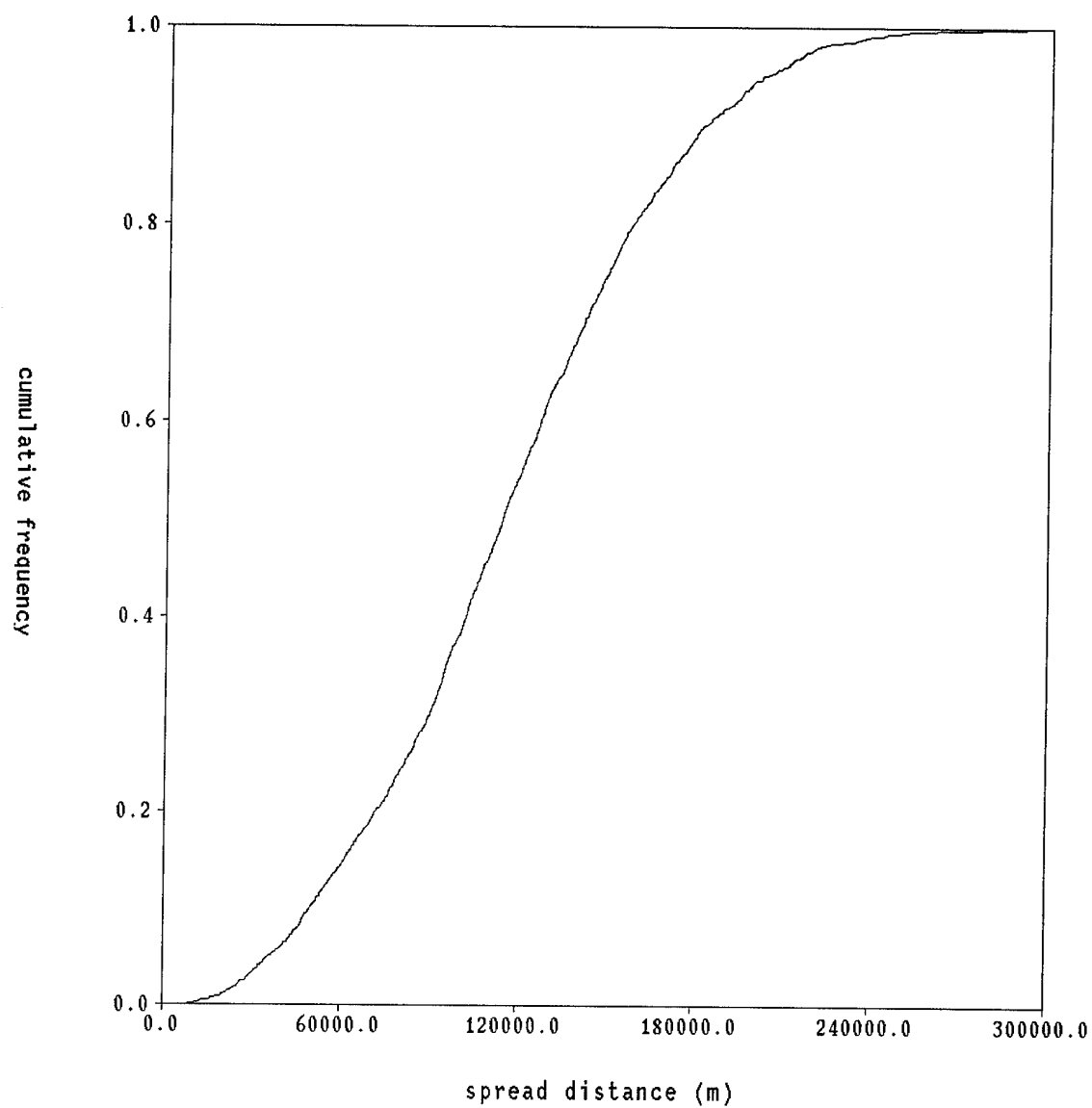
**Figure A-68. Travel Distance, Osan, 30 km**



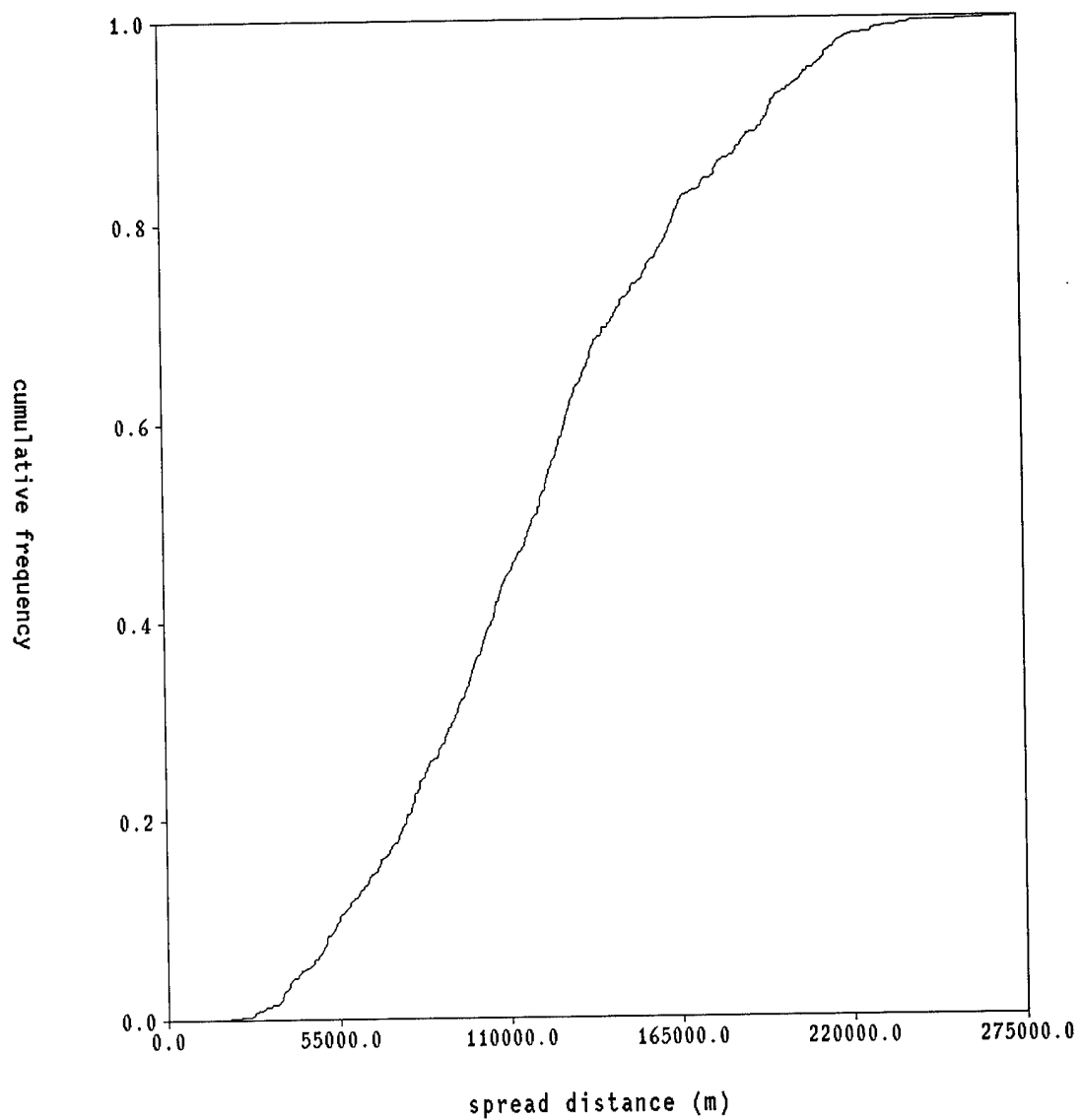
**Figure A-69. Spread Distance, Osan, 5 km**



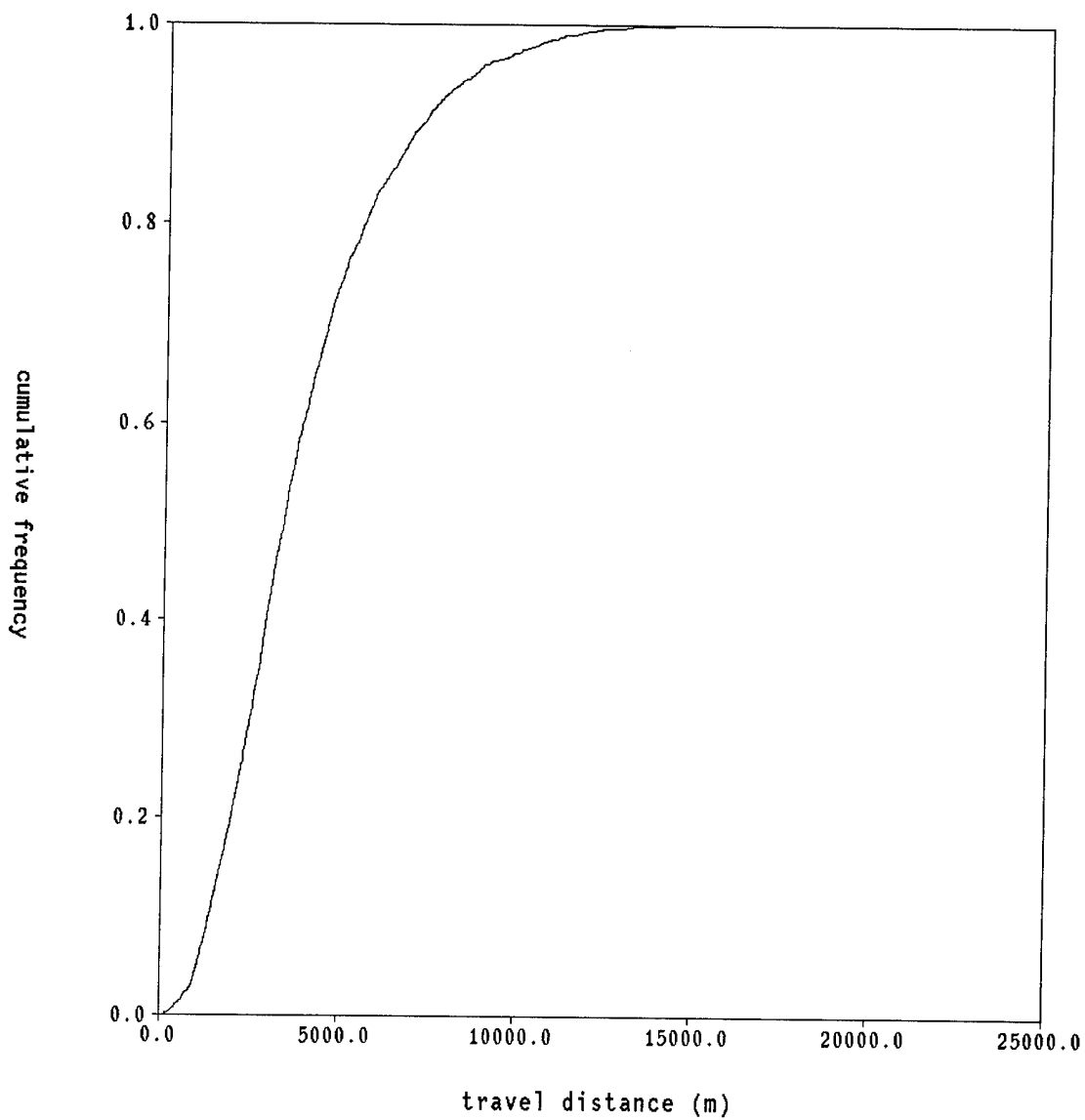
**Figure A-70. Spread Distance, Osan 10 km**



**Figure A-71. Spread Distance, Osan, 20 km**

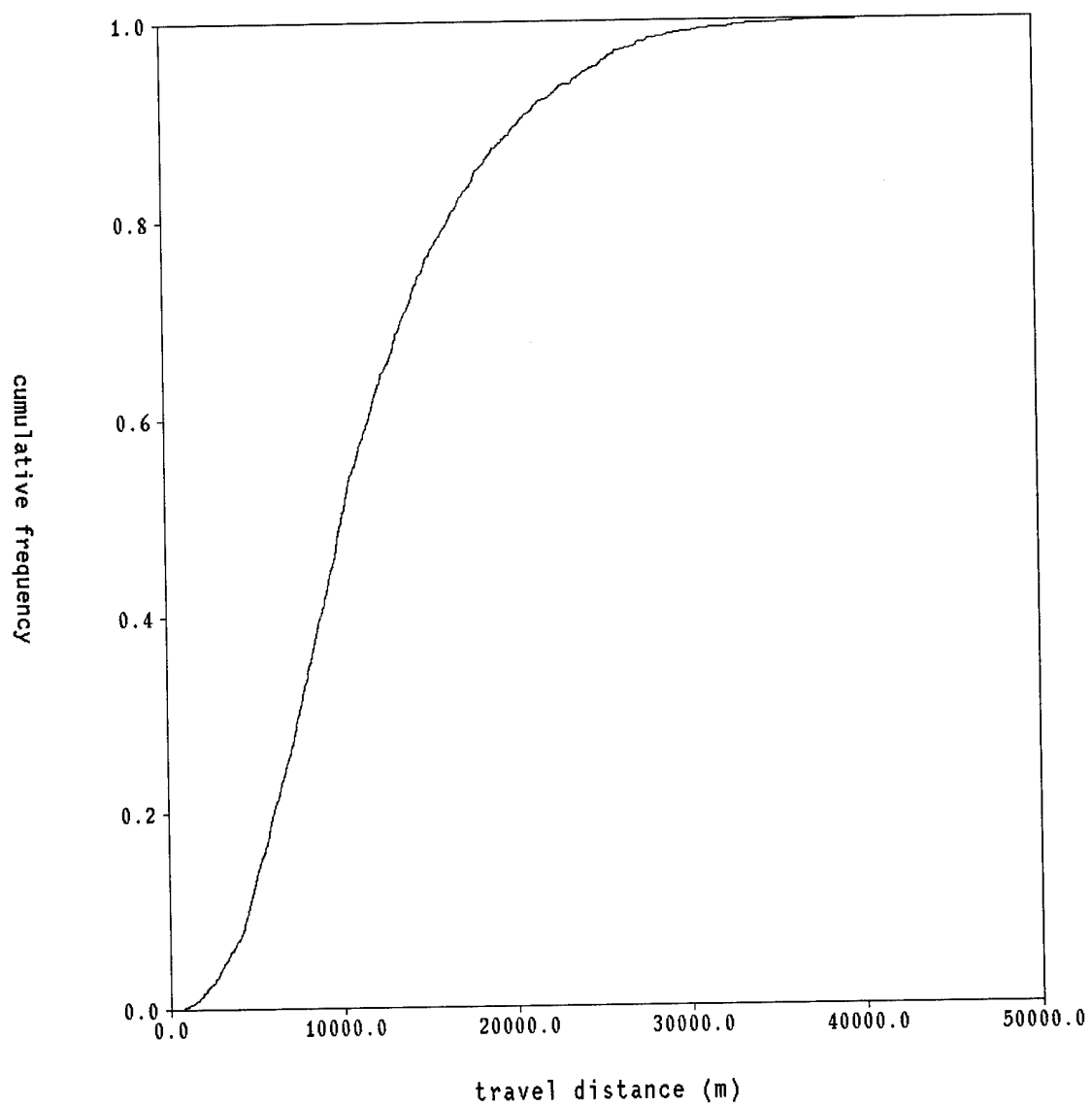


**Figure A-72. Spread Distance, Osan, 30 km**

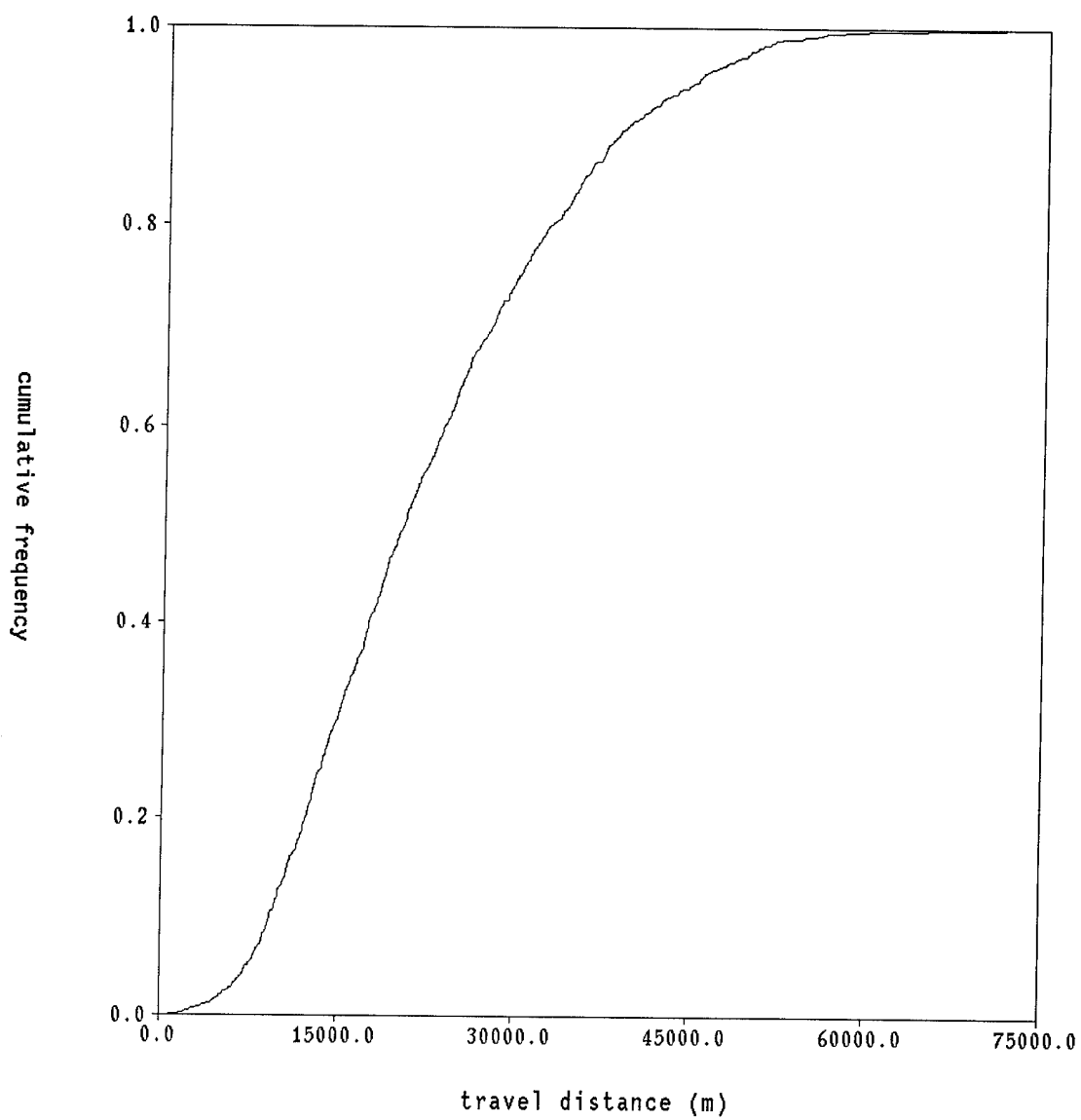


**Figure A-73. Travel Distance, Betdagan, 5 km**





**Figure A-74. Travel Distance, Betdagan, 10 km**



**Figure A-75. Travel Distance, Betdagan, 20 km**

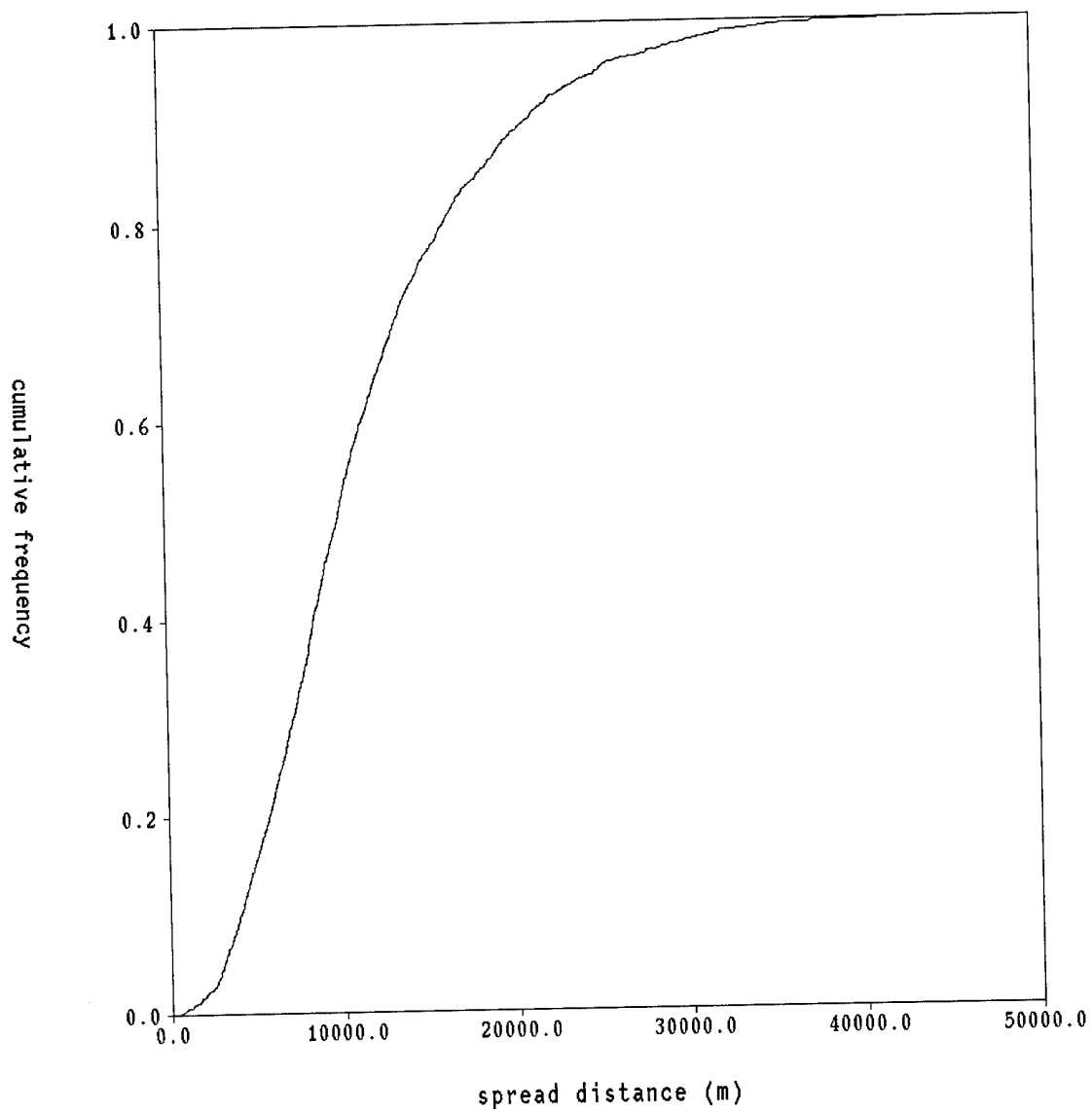
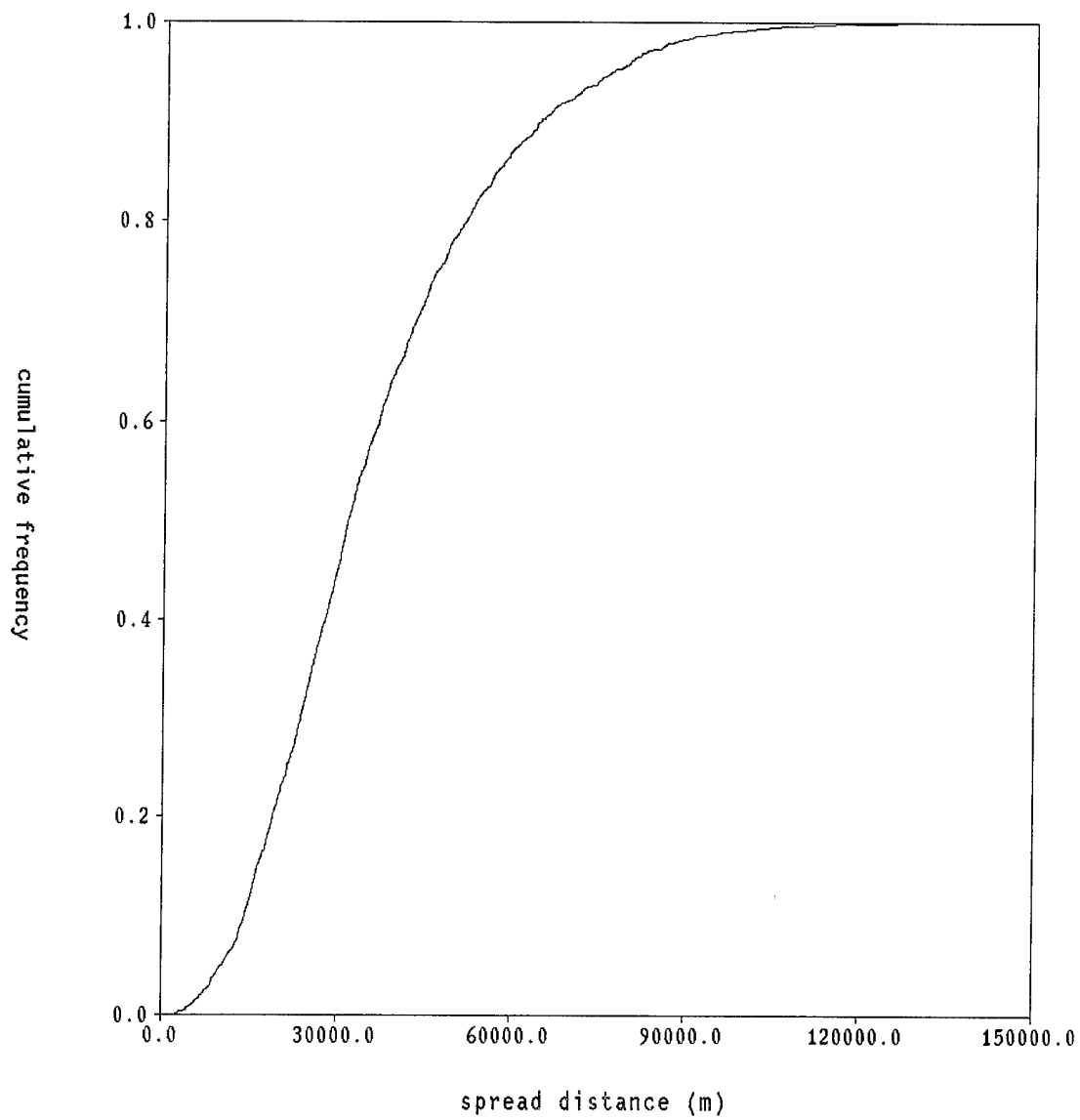
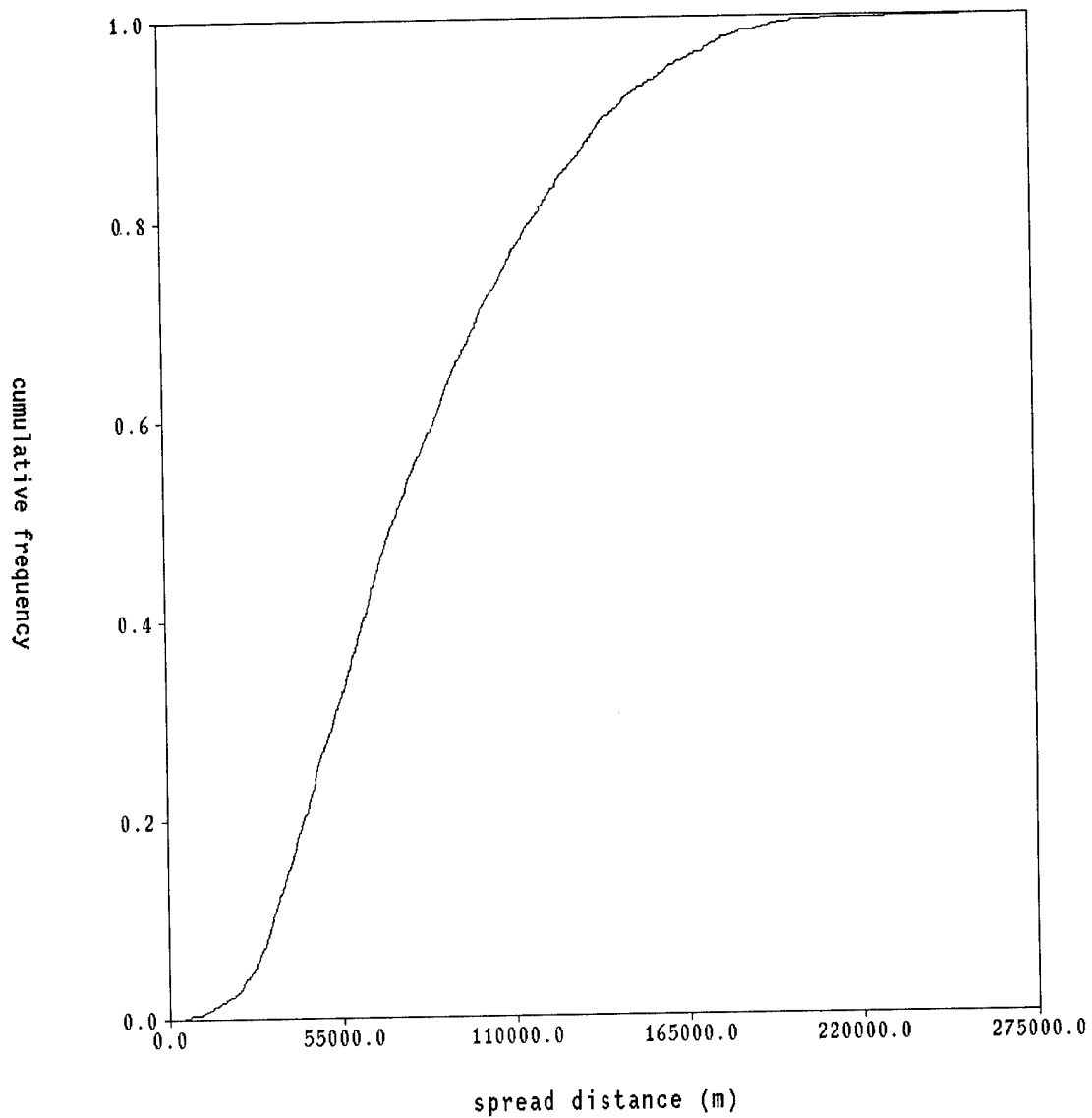


Figure A-76. Spread Distance, Betdagan, 5 km



**Figure A-77. Spread Distance, Betdagan, 10 km**



**Figure A-78. Spread Distance, Betdagan, 20 km**